Conversion Net CCN-2000/CCN-0400

Illustrated: CCN-2000 and CCN-0400 chassis.

Canary's SNMP & Web-Managed ConversionNet product group is a state-of-the-art solution for connecting today's networks, and is intended to serve as a platform for a wide range of leading-edge products. Compact, low profile, four- or twenty card slot chassis for modular media cards are available. CCN-2000/0400 Management System software is designed to function with all major SNMP Management applications. Using Canary's elegantly simple web interface, remote System Monitoring and Control can be easily accomplished over the Web. System Management is designed so that future modules with enhanced capabilities can be added to the system without firmware compatibility issues. A design feature of the Management System architecture is Operating System Independence that eliminates the expense and complexity of up-dating management software whenever a user's network operating system undergoes a revision. When the OS changes, Canary's simple, intuitive Web interface remains easily navigated where custom graphic user interface (GUI) methods risk becoming obsolete and unuseable.

ConversionNet product evolution is continuing with the development of Single-Fiber, Bi-Directional and CWDM wavelength converters and passive CWDM Multiplexer/De-multiplexer modules. Expected soon are Fibre Channel, 10 Gigabit, Multi-Rate Transponder and Switch modules that will enable users of installed CCN-2000s to keep their units current as network bandwidth and protocol needs expand.

Pushing the leading edge … advancing the state-of-the-art.

CCN-2000/CCN-0400
Modular Converter Chassis Group

Features:

Optional Redundant Power Supply or Fans

Hall Effect sensors monitor Fan speeds

Single-Fiber, Bi-Directional connections for Gigabit & Fast Ethernet

CWDM Media Converters and 4 & 8 channel Optical Multiplexers

SNMP , Web-based, and Console port Management

Has a wide array of traps and event counters

Management software is Operating System independent

Simple, intuitive management interface

A state-of-the-art platform for a new generation of network products.

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Product Specifications

CCN-2000

Power Supply:
- Modular, auto-sensing, hot swappable
- 100 / 240 VAC, 2.0 Amp, 50 / 60 Hz
- -48 Volt DC

Mechanical:
- Height: 3.5" (9.0 cm)
- Length: 16.0" (41.0 cm)
- Width: 17.4" (45.0 cm)
- Ship Weights: Chassis: 11.0 lb (5.0 Kg)
- Single Card: 0.8 lb (0.4 Kg)

CCN-0400

Power Supply:
- Internal auto-sensing
- 100 / 240 VAC, 2.0 Amp, 50 / 60 Hz

Mechanical:
- Height: 1.7" (4.3 cm)
- Length: 7.9" (20.0 cm)
- Width: 10.0" (25.5 cm)
- Ship Weights: Chassis: 3.0 lb (1.4 Kg)

CCN-2000 & CCN-0400

Environmental:
- Operating Temp.: 0 to 49ºC
- Storage Temp.: -10 to 66ºC
- Relative Humidity: 5% to 95% non-condensing

Regulatory:
- Designed in compliance with CE, UL, CSA & TUV standards, ANSI X3T1 FC-AL
- IEEE 802.3,u,z,A/B,x
- Class 1 lasers conform to US 21CFR(J), EN 60825-1, UL 1950 and IEC-825

Warranty:
- Five (5) Years, parts and labor

CCN-2000/CCN-0400 Modular Converter Chassis Group

The pages that follow have the following ordering and other information about Canary CCN-2000/CCN-0400 Modular Converter Chassis Group products:

RWTÜV USA INC.
Subsidiary of RWTÜV Systems GMBH Germany
ISO 9001 : 2000

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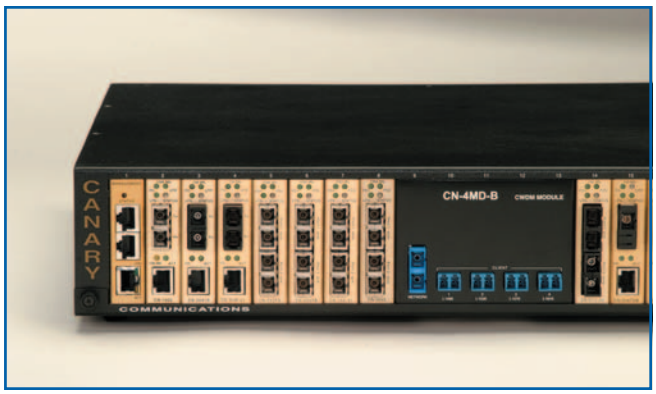
CCN-2000/CCN-0400 Chassis

Overview and capabilities



Illustrated: CCN-2000 connections

Building on the proven CCM-1600 product group, Canary's feature-rich ConversionNet-2000 product group has redefined the state-of-the-art for Media Converter technology and performance and is intended to serve as the platform of choice for a wide range of leading-edge products. New system capabilities are constantly being added, as existing ones are continually refined.

With both SNMP & Web-based management, Canary's CCN-2000/0400 products are an economical, established standard solution for connecting today's networks. Included is the CCN-2000, a low profile chassis with twenty modular card slots and two modular power supply bays for redundant power. The CCN-0400 is a four-slot chassis with a single, internal, auto-sensing power supply. Each chassis can be loaded with a variety of mixed media conversion card modules for Fast and Gigabit Ethernet. Both chassis can utilize Canary's very compact, Management System software that is designed to function with HP Openview™, IBM'S TIVOLI™ and similar (SNMP) management platforms. Canary's elegantly simple web interface, allows remote System monitoring and control to be easily accomplished over the Web ... and as a bonus, functions as the System user interface without the complexity of a separate GUI (graphic user interface).

CCN-2000/CCN-0400 Chassis

***CCN-0400** – Four slot Chassis*

***CCN-2000** – 20 slot Chassis*

CCN-2000 Chassis

The CCN-2000 chassis sets a high standard for enclosure fit and finish. The 19-inch wide, 2U high, black chassis contrasts with the gold anodized faceplates of its twenty media conversion card modules. Unique features include: a full width (across the front) air inlet chamber to ensure superior cooling across all cards; rack mounting brackets with two sets of screw hole patterns (one set allows for a more recessed position in the rack, the other positions the CCN-2000 chassis to maximize cooling air in-flow); and a single chassis-wide cross bar, using two thumb screws, locks in-place all modules (releasing the thumb screws allows the bar to drop down, clearing the way for easy card insertion). Each chassis comes standard with one auto-sensing AC Power Supply and integrated Fan assembly. The CCN-2000 can be ordered with an optional Redundant Power Supply and integrated Fan, or a negative 48 VDC Power supply with integrated Fan assembly.

Alternatively, a separate intelligent FAN module, [CN-20RFAN] may be installed for additional cooling capacity. Each Power Supply and FAN module has on-board (1) an environmental air temperature sensor, (2) analog-to-digital converters to measure power voltages, and (3) a Hall-effect sensor for measuring fan rotation – an innovation used for early fault detection. Each Power Supply or FAN module has an externally visible bi-color status LED that displays green when all measured performance variables are within range and red when otherwise.

CCN-0400 Chassis

The compact, Manageable four-slot CCN-0400 uses the same CCN-2000 card modules and has similar features. The CCN-0400 has several built-in system sensors to monitor chassis function. As in the CCN-2000, there is (1) an internal environmental air temperature sensor, (2) analog-to-digital converters to measure power voltages, and (3) a Hall-effect sensor for measuring fan rotation and reporting non-normal operation.

The CCN-2000/CCN-0400 product group has continued to expand its capabilities with the addition of Single-Fiber, Bi-Directional converters, converters with active CWDM (Coarse Wavelength Division Multiplexing) transceivers, and passive four and eight-channel CWDM Multiplexer / De-multiplexer modules. Expected soon are the additions of High speed 1.062 Giga-Baud Fibre Channel Fiber-to-Fiber cards, six-port Switch modules with a Gigabit uplink port, a Multi-Rate media card supporting data rates spanning 10 Mbs through 2.7 Gigabits per second and a 10 Gigabit Fiber-to-Fiber card. These product additions will enable users of the large installed base of CCN-2000s to upgrade and keep their units current as network bandwidth and protocol needs continue to evolve. In the future, the CCN-2000 and CCN-0400 Chassis group will continue to serve as the platform for a wide range of innovative connectivity products. The CCN-400 has no provision for a redundant Power Supply or Fans, and is not loadable with (4 & 8 channel) Coarse Wavelength Division Multiplexer modules.

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CCN-2000/CCN-0400 Chassis

***CCN-0400** – Four slot Chassis*

***CCN-2000** – 20 slot Chassis*

***CN-XXXX** – Media Conversion Modules*

- CCN-2000 — 20 card-slot chassis: all slots available for media conversion or other functions
- Hot-swappable, auto-sensing 100/240 VAC Power Supply with integrated FAN assembly
- Measurement and logging of internal Chassis, Power Supply and Module temperatures
- Hall-effect sensors incorporated in all FAN assemblies for early fault awareness
- CCN-2000 chassis can be rack-mounted in two positions: Recessed for additional connector clearance or Forward for improved airflow cooling
- Optional Redundant power supply or optional -48 VDC power supply
- Full array of diagnostic/status LED indicators for system/ modules
- "Ground-before-Data" type card connections and a 'soft start' feature to minimize (power) demand surges through chassis and modules
- Redundant, hot-swappable, modular FAN assembly
- Single-Fiber, Bi-Directional single-mode modules available for Fast and Gigabit Ethernet
- Passive Wavelength Division Multiplexers (4 & 8 channels) for ITU specified CWDM wavelengths
- Wavelength Division Multiplexing (Active) transceivers launching ITU specified CWDM wavelengths
- CCN-0400 — compact, 4 card-slot chassis: Has same features as above except: (1) Has single Thermal Couple for monitoring combined Chassis & internal Power Supply temperature, (2) Has single, internal, auto-sensing 100/240 VAC power supply and integrated FAN assembly.

Ordering Information

Model Number	Description	Power Source	Shipping Weight
CCN-0400	4-Slot chassis with internal, auto-sensing AC Power Supply and FAN	100/240VAC Line	4.0 lb (1.8 Kg)
CCN-2000	20-Slot chassis with single AC Power Supply + Integrated FAN with Hall-Effect Sensors	100/240VAC Line	14.0 lb (6.2 Kg)
CN-200048V	20-Slot chassis with single –48 VDC Power Supply + Integrated Fan with Hall-Effect Sensors	Neg. 48 VDC Source	14.0 lb (6.2 Kg)
CN-20MGNT	Management Module with (2) RJ-45 Network ports & (1) 10-pin Serial port + Serial cable**	Internal Chassis	1.0 lb (0.4 Kg)
CN-XXXX	Single Media Conversion Module	Internal Chassis	1.0 lb (0.4 Kg)
CN-20RP	Single Redundant AC Power Supply Module + Integrated FAN with Hall-Effect Sensors	100/240VAC Line	2.0 lb (0.91 Kg)
CN-RP48V	Single Redundant –48 VDC Power Supply Module + Integrated FAN with Hall-Effect Sensors	Neg. 48 VDC Source	2.0 lb (0.91 Kg)
CN-20RFAN	Single Redundant FAN Module with Hall-Effect Sensors for early fault detection	Internal Chassis	2.0 lb (0.91 Kg)
CN-CD9RJ10P	Serial Cable assembly: Standard RS-232, DB-9 type to 10-Pin pattern, RJ-45 style	N/A	0.5 lb (0.23 Kg)
CN-BRK-08	Standard Side-mount Rack Brackets for CCN-2000 chassis	N/A	0.5 lb (0.23 Kg)
CN-BRK-09	Standard Side-mount Rack Brackets for CCN-0400 chassis	N/A	0.5 lb (0.23 Kg)
CN-BRK-10	Vertical position (Right-side or Left-side down) Rack-mount brackets for CCN-0400 chassis	N/A	0.5 lb (0.23 Kg)

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CCN-2000/CCN-0400 Management System

System Interfaces and capabilities: Out-of-band, SNMP, and web based

The optional remote Management Module occupies a single chassis slot and provides management and monitoring access over the local area network. This frees the administrator from the necessity of direct physical access to configure the system or its modules. System Management was designed to be "plug and go" so that future modules with additional or enhanced capabilities can be plugged into the system without any firmware compatibility worries and, in most cases, with no firmware updates required. Each module contains non-volatile memory for storing user configured management parameters and for describing the module characteristics and capabilities to the management firmware. The Management Module also provides a Simple Network Management Protocol (SNMP) agent that transmits traps and alerts when problems or significant system events are detected.

The Management Module is shipped from the factory configured for its networking parameters to be obtained using the standard BOOTP protocol. If the user's network is using a BOOTP server (or a DHCP server that supports BOOTP devices), no manual configuration is required for remote access. The system will automatically obtain its network parameters from the network server. It will still be necessary to specify SNMP Manager parameters because these details are not part of the standard BOOTP protocol. However, any of the available user interface options can be used.

An important feature of Canary's CCN-2000/CCN-0400 Management is a philosophy and System architecture that is designed to be Operating System independent. This independence eliminates the expense and complexity of up-dating management software every time a user's network operating system (OS) undergoes a revision. Canary's approach is to provide a simple, intuitive Web interface that is easily navigated rather than a custom graphic user interface (GUI) that risks becoming obsolete when the OS changes.

Canary provides three Management interfaces for System Management control and configuration.

1. Command-line User Console (out-of-band),
2. Simple Network Management Protocol (SNMP) agent, and
3. The CANARY Web Server

These straightforward interfaces require no special application software to be installed on the remote management computer, avoiding significant application maintenance expenses.

CCN-2000/CCN-0400 Management System

System Interfaces and capabilities: Out-of-band, SNMP, and Web-based

All management and configuration is accomplished using standard protocols to communicate with standard host applications. The command-line User Console requires a standard terminal program (e.g. HyperTerminal) communicating over the management serial port, or it requires a TELNET client program for network access. The SNMP agent uses the SNMP protocol to communicate with any general SNMP management application, e.g. Hewlett-Packard's OPENVIEW© or IBM's TIVOLI©.

The User Console is a simple command line interface that can be used both in-band and out-of-band. Out-of-band access requires a terminal emulation program running on a host computer connected to the management card serial port (e.g. Microsoft Windows HyperTerminal). In-band access uses a TELNET client program. Typically, you will only use the User Console for the initial system configuration. However, it also provides non-graphical monitoring and management features comparable to the other interface options.

The SNMP agent provides an in-band user interface option by enabling the use of a standard SNMP management application to access system configuration, event, status, and diagnostic summary data. It supports integration with SNMP managed networks, including the generation of asynchronous traps (alerts) when significant system events or problems are detected.

Canary's embedded Web Server provides a simple, intuitive graphical user interface (GUI) option by enabling in-band access to System event, configuration, status, and diagnostic summary data, making it accessible by any standard Web Browser (e.g. Netscape© or Internet Explorer©). All System information is presented on a few pages and is clearly displayed in simple, concise, tabular form using a few clicks of the keyboard for selection. Note that (with few exceptions) the management and monitoring capabilities of each interface are grouped similarly. Thus learning one interface makes it easier to learn the others. Because it only uses standard web protocols, no special application software needs to be installed on the host computer.

- Management interfaces include: Console Serial port (out-of-band), SNMP manager (in-band) and Web-based
- SNMP Management interface compatible with HP Openview™, IBM'S TIVOLI™ and similar applications
- Supports standard RFC 1213 MIB II and IP/UDP — including a wide array of traps and event counters
- Console, Serial RS-232 port for local (out-of-band) chassis and module configuration, and link testing
- Management software is Operating System independent – no GUI that needs to be periodically upgraded
- Web manager is simple, intuitive in use –just toggle pages to display variables and their current status
- Management software structured for Web access, with upgrade paths for easy definition and activation of additional module types and/or monitor-able variables
- SNMP Management module — card inserts in any chassis slot
- Capability to remotely enable/disable or reset Modules, individual ports or links
- Complete Module EEPROM reporting: model type, revision and serial numbers, port types etc.
- Provides Dynamic Monitoring, Logging and reporting of key, user-selected variables for each module:
  Module condition — Normal, Crippled (but functioning), Failed;
  Module temperature, port Link status, duplex-mode, board defaults;
  Voltage levels — High and Low boundaries and actual on each Module; and
  Voltage levels — FAN assembly, Power Supply output, overall system levels.

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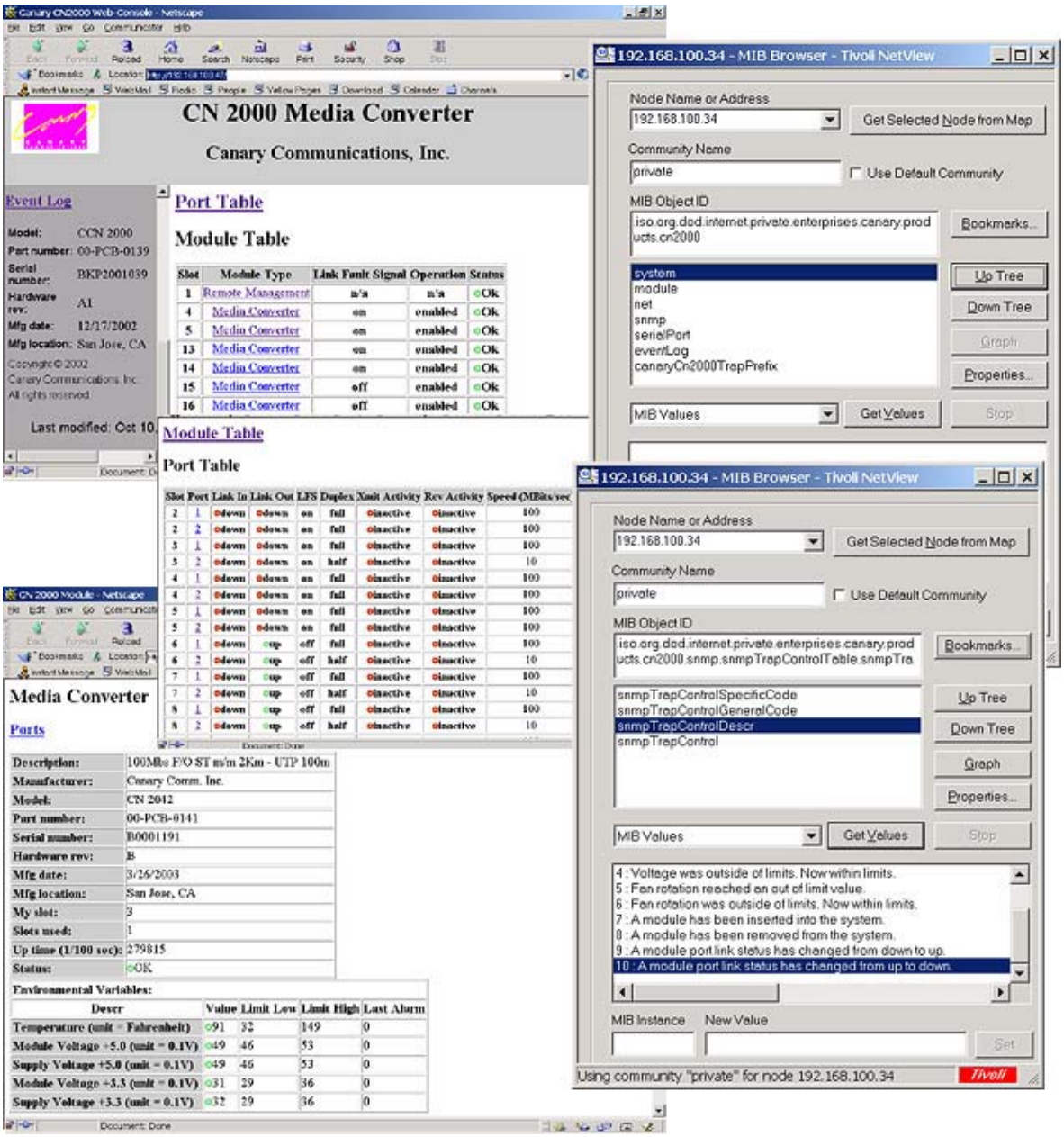
CCN-2000/CCN-0400 Management System

System Interfaces and capabilities: Out-of-band, SNMP, and web based

CCN-2000/0400 Management interfaces



NOTES

1. Images in left column show Canary Web Management display pages
2. Images in right column show typical screens using the IBM Tivoli NetView© SNMP manager

CCN-2000/CCN-0400 Media Conversion

Overview and capabilities

CCN-2000 hot-plug removable, media conversion modules i.e. "media cards", connect twisted-pair and fiber optic segments or transition between multi-mode and single-mode media. They can be dynamically removed, inserted, or moved to a new chassis without any power cycling or rebooting required. Use Canary's CCN chassis converters to economically distribute high-speed server capacity to users throughout the network. They are ideal for connecting desktops with low-cost work-group switches and servers; or for high-bandwidth backbone, switch-to-switch links.

Each Media Converter module has on-board intelligence and sensors for independent local management, self-diagnostics, and environmental monitoring. Canary's first in the industry Link Fault Signaling© (LFS) circuitry supports fast switch-to-switch or host-to-router link recovery when there is a connection path failure. If a segment link fails, LFS severs the link with each host/switch/router on the other segment, making them instantly aware of the connection fault. Any available internal recovery processes (e.g. Spanning Tree, OSPF etc.) running on these devices are immediately triggered to quickly execute redundant path selection.

The following sections present functional descriptions and model numbers of CCN-2000/CCN-0400 active Media Conversion modules, passive CWDM Optical Multiplexer/De-Multiplexer modules and active Media Conversion modules with transceivers providing ITU specified CWDM wavelengths.

Standard Gigabit Copper-to-Fiber Media Cards

CN-10XX – Gigabit Ethernet UTP-to-Fiber: 1000BASE-T to 1000BASE-SX/LX/ZX

Canary's CCM-10XX Gigabit Ethernet Media Converters combine existing 100 meter Category-5(E) UTP and Fiber optic segments to deliver Gigabit data across the network. They are ideal for data intensive backbones in the enterprise or campus and can be used to take advantage of low-cost Gigabit capable switches. Use Canary's Gigabit UTP-to-Fiber converters to economically distribute Gigabit Ethernet capacity to user desktops throughout the network as bandwidth demand increases.

Standard CN-1055 multi-mode Media Converters guarantee minimum transmission distances of 220+ meters over 62.5/125 μm fiber or 500/550+ meters (depending on bandwidth) over 50.0/125 μm fiber. Standard CN-1031 single-mode models provide transmission distances ranging from 10 to 70 kilometers over 9.0 μm single-mode fiber.

- **1000BASE-T Autonegotiation for Full-duplex and Half-duplex operation with Flow-Control and;**
- **Switch selectable, Fiber-Port Autonegotiation for common, end-to-end link awareness and Flow-Control, or for independent connection to Gigabit fiber ports on older switches**
- **Internal Auto-sensing, MDI / MDI-X crossover switch for Network Interface Card or Switch connections**
- **Transparent to Flow-Control commands such as PAUSE**
- **A full array of status / diagnostic LEDs**

Ordering Information

Model Numbers	Media Types	Min. Tx PWR	Max. Tx PWR	Rx Sensitivity	Min. PWR Budget	Max.PWR Budget	Max. Input PWR	Connector Type	Wavelengths (ηm)	Transmit Distance
CN-1055	UTP / MM	-9.5 dBm	-4.0 dBm	-17.0 dBm	7.5 dB	13.0 dB	0.0 dBm	SC	850 ηm	220/550 m
CN-1056	UTP / MM	-10.0 dBm	-4.0 dBm	-17.0 dBm	7.0 dB	13.0 dB	0.0 dBm	LC	850 ηm	220/550 m
CN-1055E	UTP / MM	/	/	/	/	/	/	/	/	/
Specifications above in blue are for multi-mode, fiber connectors. Specifications below for single-mode, fiber connectors.										
CN-1031	UTP / SM	-10.0 dBm	-3.0 dBm	-20.0 dBm	10.0 dB	17.0 dB	-3.0 dBm	SC	1310 ηm	10 Km
CN-1036	UTP / SM	-11.0 dBm	-3.0 dBm	-19.0 dBm	8.0 dB	15.0 dB	-3.0 dBm	LC	1310 ηm	10 Km
CN-1031E33	UTP / SM	-5.0 dBm	0.0 dBm	-24.0 dBm	19.0 dB	24.0 dB	-3.0 dBm	SC	1310 ηm	30 Km
CN-1031E43	UTP / SM	-5.0 dBm	0.0 dBm	-24.0 dBm	19.0 dB	24.0 dB	-3.0 dBm	SC	1550 ηm	50 Km
CN-1031E75	UTP / SM	-2.0 dBm	3.0 dBm	-24.0 dBm	22.0 dB	27.0 dB	-3.0 dBm	SC	1550 ηm	70 Km

** NOTE: CN Chassis converters are available as card modules designed for Canary's CCM-1600 Chassis models and as standalone units. Please refer to the CCM-1600 Data Sheets or the Gigabit Ethernet, UTP-to-Fiber Data Sheet for additional information*

More versions of the CN-10XX series may be found on the Canary web site as they become available.

Standard Gigabit Fiber-to-Fiber Media Cards

CN-55XX – Gigabit Ethernet Fiber-to-Fiber: 1000BASE-SX to 1000BASE-SX/LX/ZX

Canary's CN-55XX Gigabit Ethernet Fiber-to-Fiber Media Converters deliver economical long-range Gigabit data capacity as they link low-cost multi-mode ports with single-mode Fiber optic segments. They are ideal for data intensive backbones in the enterprise or across the campus and can be used to take advantage of low-cost Gigabit capable switches. Use Canary's Gigabit Fiber-to-Fiber converters to economically distribute Gigabit Ethernet capacity to remote user desktops across the network as bandwidth demand increases.

Standard Gigabit multi-mode ports provide minimum transmission distances of 220+ meters over 62.5/125 μm fiber or 500/550+ meters (depending on bandwidth) over 50.0/125 μm fiber. Standard Gigabit models with single-mode ports provide transmission distances ranging from 10 to 70 kilometers over 9.0/125 μm single-mode fiber.

- **Simple plug and go installation**
- **Status / Diagnostic LED Indicators**
- **Transparent to Flow-Control commands such as PAUSE**

Ordering Information

Model Numbers	Media Types	Min. Tx PWR	Max. Tx PWR	Rx Sensitivity	Min. PWR Budget	Max.PWR Budget	Max. Input PWR	Connector Type	Wavelengths (ηm)	Transmit Distance
Gigabit converters with standard multi-mode fiber port connectors are designated by (CN-55XX) or (CCM-56XX) and have similar power and sensitivity specifications.										
CN-5555 **	MM / MM	-9.5 dBm	-4.0 dBm	-17.0 dBm	7.5 dB	13.0 dB	0.0 dBm	SC/SC	850/850	220/550 m ea.
CN-5656 **	MM / MM	-10.0 dBm	-4.0 dBm	-17.0 dBm	7.0 dB	13.0 dB	0.0 dBm	LC/LC	850/850	220/550 m ea.
CN-5555E	/	/	/	/	/	/	/	/	/	/
Specifications above in blue are for multi-mode, fiber connectors. Specifications below for single-mode, fiber connectors.										
CN-3131 **	SM / SM	-10.0 dBm	-3.0 dBm	-20.0 dBm	10.0 dB	17.0 dB	-3.0 dBm	SC/SC	1310/1310	10Km each
CN-5531	MM / SM	-10.0 dBm	-3.0 dBm	-20.0 dBm	10.0 dB	17.0 dB	-3.0 dBm	SC/SC	1310 ηm	550m / 10 Km
CCM-5636	MM / SM	-11.0 dBm	-3.0 dBm	-19.0 dBm	8.0 dB	15.0 dB	-3.0 dBm	LC/LC	1310 ηm	550m / 10 Km
CN-5531L	MM / SM	-5.0 dBm	0.0 dBm	-24.0 dBm	19.0 dB	24.0 dB	-3.0 dBm	SC/SC	1310 ηm	550m / 30 Km
CN-5531XL	MM / SM	-5.0 dBm	0.0 dBm	-24.0 dBm	19.0 dB	24.0 dB	-3.0 dBm	SC/SC	1550 ηm	550m / 40 Km
CN-5531E45	MM / SM	-5.0 dBm	0.0 dBm	-24.0 dBm	19.0 dB	24.0 dB	-3.0 dBm	SC/SC	1550 ηm	550m / 40 Km
CN-5531E75	MM / SM	-2.0 dBm	3.0 dBm	-24.0 dBm	22.0 dB	27.0 dB	-3.0 dBm	SC/SC	1550 ηm	550m / 70 Km

** NOTE: CN Chassis converters are available as card modules designed for Canary's CCM-1600 Chassis models and as standalone units. Please refer to the CCM-1600 Data Sheets or the Gigabit Ethernet, Fiber-to-Fiber Data Sheet for additional information*

*** Reference optical specifications for standard multi-mode or single-mode fiber port connectors. Other table specifications for second (alternate) fiber port connector.*

More versions of the CN-55XX series may be found on the Canary web site as they become available.

Standard 100Mbs Copper-to-Fiber Media Cards

CN-204X– Standard multi-mode & single-mode series: 100BASE-TX to 100BASE-FX

Canary's Fast Ethernet Media Converters connect twisted-pair and fiber optic segments to extend Fast Ethernet links. They are ideal for connecting user desktops with low-cost work-group switches and servers; or for switch-to-switch links. Use Canary's UTP-to-Fiber Media Converters to economically distribute Fast Ethernet capacity to user desktops throughout the network.

CN-204X Converter modules are the first in the industry to speed-up Spanning Tree link recovery by employing Link Fault Signaling (LFS) technology while supporting Far-End Fault-Indication and parallel detection.

- Card features and performance mirror that of Canary's stand-alone CFT 100 Mbs copper-to-fiber converters
- Switch for Hard-Setting Full-Duplex or 100BASE-T Autonegotiation for 100 Mbs, Full and Half-duplex operation
- Internal Auto-sensing, MDI / MDI-X crossover switch for proper Network Interface Card or Switch connections
- Switch enabled Link Fault Signaling (LFS) – Forwards lost link signals to each connected host
- A full array of status / diagnostic LEDs
- Additional models include: Single-Fiber Bi-Directional single-mode, Extended Reach multi-mode and versions launching ITU specified CWDM transmitter wavelengths

Ordering Information

Model Numbers	Media Types	Min. Tx PWR	Max. Tx PWR	Rx Sensitivity	Min. PWR Budget	Max.PWR Budget	Max. Input PWR	Connector Type	Wavelengths (ηm)	Transmit Distance
CN-2041	UTP / MM	-20.0 dBm	-14.0 dBm	-31.0 dBm	11.0 dB	17.0 dB	-8.0 dBm	SC	1310 ηm	2000 m
CN-2042	UTP / MM	-20.0 dBm	-14.0 dBm	-31.0 dBm	11.0 dB	17.0 dB	-8.0 dBm	ST	1310 ηm	2000 m
CN-2046	UTP / MM	-19.0 dBm	-14.0 dBm	-32.0 dBm	13.0 dB	18.0 dB	-8.0 dBm	LC	1310 ηm	2000 m
Specifications above in blue are for multi-mode, fiber connectors. Specifications below for single-mode, fiber connectors.										
CN-2081-SM	UTP / SM	-16.0 dBm	-9.0 dBm	-34.0 dBm	18.0 dB	25.0 dB	-7.0 dBm	SC	1310 ηm	18 Km
CN-2041-SM	UTP / SM	-15.0 dBm	-8.0 dBm	-34.0 dBm	19.0 dB	26.0 dB	-7.0 dBm	SC	1310 ηm	30 Km
CN-2042-SM	UTP / SM	-15.0 dBm	-8.0 dBm	-34.0 dBm	19.0 dB	26.0 dB	-7.0 dBm	ST	1310 ηm	30 Km
CN-2046-SM	UTP / SM	-15.0 dBm	-8.0 dBm	-28.0 dBm	13.0 dB	20.0 dB	-8.0 dBm	LC	1310 ηm	20 Km
CN-2041-E43	UTP / SM	-5.0 dBm	0.0 dBm	-35.0 dBm	30.0 dB	35.0 dB	0.0 dBm	SC	1310 ηm	50 Km
CN-2041-E85	UTP / SM	-5.0 dBm	0.0 dBm	-35.0 dBm	30.0 dB	35.0 dB	0.0 dBm	SC	1550 ηm	80 Km

**NOTE 1: CN-204X models are available as uni-Directional (D) versions that allow one-way traffic e.g. CN-2041D. For special order, contact Canary for information.*

** NOTE 2: CN Chassis converters are available as card modules designed for Canary's CCM-1600 Chassis models and as standalone units. Please refer to the CCM-1600 Data Sheets or Fast Ethernet, UTP-to-Fiber Data Sheet for additional information*

More versions of the CN-204X series may be found on the Canary web site as they become available.

Standard 100 Mbs Fiber-to-Fiber Media Cards

CN-BXXX and CN-CXXX– Standard Fast Ethernet Fiber-to-Fiber: 100BASE-FX to 100BASE-FX

Canary's CN-YXXX Fast Ethernet Fiber-to-Fiber Media Converters deliver economical long-range Fast data transmission as they link low-cost multi-mode ports with single-mode Fiber optic segments. They are ideal for connecting user desktops with low-cost work-group switches and servers; or for long distance switch-to-switch links. Canary Media Converters were the first in the industry to speed-up Spanning Tree link recovery by employing Link Fault Signaling (LFS) technology that forwards lost link signals to each connected host.

- **Simple plug and go installation**
- **Status / Diagnostic LED Indicators**
- **Automatic Link Fault Signaling (LFS) Forwards lost link signals to each connected host**

Ordering Information

Model Numbers	Media Types	Min. Tx PWR	Max. Tx PWR	Rx Sensitivity	Min. PWR Budget	Max.PWR Budget	Max. Input PWR	Connector Type	Wavelengths (ηm)	Transmit Distance
CN-B113 **	MM / MM	-20.0 dBm	-14.0 dBm	-31.0 dBm	11.0 dB	17.0 dB	-8.0 dBm	SC/SC	1310/1310	2 Km Each
CN-B123 **	MM / MM	-20.0 dBm	-14.0 dBm	-31.0 dBm	11.0 dB	17.0 dB	-8.0 dBm	SC/ST	1310/1310	2 Km Each
CN-B223 **	MM / MM	-20.0 dBm	-14.0 dBm	-31.0 dBm	11.0 dB	17.0 dB	-8.0 dBm	ST/ST	1310/1310	2 Km Each
Specifications above in blue are for multi-mode, fiber connectors. Specifications below for single-mode, fiber connectors.										
CN-B9191 **	SM / SM	-15.0 dBm	-8.0 dBm	-34.0 dBm	19.0 dB	26.0 dB	-7.0 dBm	SC/SC	1310/1310	30 Km Each
CN-C113	SM / MM	-15.0 dBm	-8.0 dBm	-34.0 dBm	19.0 dB	26.0 dB	-7.0 dBm	SC/SC	1310 ηm	2 Km / 30 Km
CN-C123	SM / MM	-15.0 dBm	-8.0 dBm	-34.0 dBm	19.0 dB	26.0 dB	-7.0 dBm	SC/ST	1310 ηm	2 Km / 30 Km
CN-C223	SM / MM	-15.0 dBm	-8.0 dBm	-34.0 dBm	19.0 dB	26.0 dB	-7.0 dBm	ST/ST	1310 ηm	2 Km / 30 Km
CN-C213	MM / SM	-15.0 dBm	-8.0 dBm	-34.0 dBm	19.0 dB	26.0 dB	-7.0 dBm	ST/SC	1310 ηm	2 Km / 30 Km
CN-C113E4	MM / SM	-5.0 dBm	0.0 dBm	-35.0 dBm	30.0 dB	35.0 dB	0.0 dBm	SC/SC	1310 ηm	2 Km / 50 Km
CN-C123E4	MM / SM	-5.0 dBm	0.0 dBm	-35.0 dBm	30.0 dB	35.0 dB	0.0 dBm	SC/ST	1310 ηm	2 Km / 50 Km
CN-C115E8	MM / SM	-5.0 dBm	0.0 dBm	-35.0 dBm	30.0 dB	35.0 dB	0.0 dBm	SC/SC	1550 ηm	2 Km / 80 Km
CN-C125E8	MM / SM	-5.0 dBm	0.0 dBm	-35.0 dBm	30.0 dB	35.0 dB	0.0 dBm	SC/ST	1550 ηm	2 Km / 80 Km

NOTE: CN Chassis converters are available as card modules designed for Canary's CCM-1600 Chassis models and as standalone units.
Please refer to the CCM-1600 Data Sheets or Fast Ethernet, Fiber-to-Fiber Data Sheet for additional information

*** Reference optical specifications for standard multi-mode or single-mode fiber port connectors. Other table specifications for second (alternate) fiber port connector.*

More versions of the CN Fiber-to-Fiber converters may be found on the Canary web site as they become available.

NOTES:

(1) Fiber-to-Fiber Modules with two multi-mode fiber port connectors or two single-mode fiber port connectors are treated as Boosters and are designated by a (B) in the part number e.g. (CN-B113) or (CN-B9191).

(2) Modules with one multi-mode fiber port connector and one single-mode fiber port connector are treated as Converters and are designated by a (C) in the part number e.g. (CN-C113).

(3) The numeral (1) = SC type Fiber connectors and the numeral (2) = ST type Fiber connectors. For Converters, the first digit refers to the single-mode port and the second digit refers to the multi-mode port e.g. (CN-C123) = single-mode, SC Fiber, to multi-mode ST Fiber Converter.

(4) The last digit (3 or 5) refers to transmission wavelength i.e. 1310 nanometers or 1550 nanometers.

(5) A digit following capital (E) signifies Extended transmission distance e.g. (E8) = 80 Kilometers while (E4) = 40 Kilometers (recently increased to 50 Km).

CANARY communications

Single-Fiber, Bi-Directional Single-Mode Converters for Gigabit and Fast Ethernet

Canary's Media Converters with Single-Fiber Bi-Directional Single-mode Connectors deliver long-range data access over single-mode segments while using a single strand of Fiber cable. CCN-2000/0400 Single Fiber converters are designed to free-up fiber capacity by using dual transmission wavelengths over a single strand of a duplex fiber pair. They are ideal for data intensive backbones in the enterprise or across the campus where extra fiber capacity is lacking but redundancy or additional access is needed to add channels or alternate protocols.

CCN-2000/CCN-0400 Single-Fiber, Bi-Directional Converters are functionally identical to standard units with the exception that versions designated with an A transmit at 1550 ηm and receive on 1310 ηm, while B units transmit at 1310 ηm and receive on 1550 ηm. Single-Fiber converters must be connected as complementary A & B pairs. (A and B units must be ordered in pairs because every A unit must be connected to a B unit.) For a properly functioning fiber link, one unit A must be purchased and installed on one end and one unit B must be purchased and installed at the other end. Similarly, Standalone or CCN-1600 chassis A & B units, can also be connected to complementary A & B modules used in the CCN-2000/CCN-0400 Chassis. Thus, a chassis 'A' pattern card can be connected to a 'B' pattern standalone model.

Gigabit Ethernet Copper to Single-Fiber, Bi-directional Single-Mode

CCN-1037A/B– Gigabit UTP-to-Single Fiber Bi-directional Single-Mode Converters

Canary CCN-1037A/B Gigabit Ethernet UTP-to-Single-Fiber Media Converter Modules are designed to extend the reach of Gigabit users across single-fiber (single-strand) segments. Models are available with 20 kilometer and 40 kilometer transmission ranges. They function similarly to standard duplex-fiber versions.

- 1000BASE-T Autonegotiation for Full-duplex and Half-duplex operation with Flow-Control and;
- Switch selectable, Fiber-Port Autonegotiation for common, end-to-end link awareness and Flow-Control, or for independent connection to Gigabit fiber ports on older switches
- Internal Auto-sensing, MDI / MDI-X crossover switch for Network Interface Card or Switch connections
- Uses Single-Fiber, single-mode connectors operating on 1550 ηm and 1310 ηm wavelengths
- Transparent to Flow-Control commands such as PAUSE
- A full array of status / diagnostic LEDs

Ordering Information

Model Numbers	Media Types	Min. Tx PWR	Max. Tx PWR	Rx Sensitivity	Min. PWR Budget	Max.PWR Budget	Max. Input PWR	Connector Type	Wavelengths (ηm)	Transmit Distance
CN-1037A	UTP / SM	-8.0 dBm	-3.0 dBm	-21.0 dBm	13.0 dB	18.0 dB	-3.0 dBm	SC	1550/1310	20 Km
CN-1037B	UTP / SM	-8.0 dBm	-3.0 dBm	-21.0 dBm	13.0 dB	18.0 dB	-3.0 dBm	SC	1310/1550	20 Km
CN-1037E4A	UTP / SM	-3.0 dBm	2.0 dBm	-23.0 dBm	20.0 dB	25.0 dB	-3.0 dBm	SC	1550/1310	40 Km
CN-1037E4B	UTP / SM	-3.0 dBm	2.0 dBm	-23.0 dBm	20.0 dB	25.0 dB	-3.0 dBm	SC	1310/1550	40 Km

** NOTE: CN Chassis converters are available as card modules designed for Canary's CCM-1600 Chassis models and as standalone units. Please refer to the CCM-1600 Data Sheets or Gigabit Ethernet Single-Fiber, UTP-to-Fiber Data Sheet for additional information*

More versions of the CN-1037A/B series may be found on the Canary web site as they become available.

Gigabit Ethernet Duplex-Fiber to Single-Fiber, Bi-Directional

CN-5537A/B– Multi-mode to Single-Fiber, Bi-directional Single-Mode Converters

Canary CN-5537A/B Gigabit Ethernet Fiber-to-Fiber, Single-Fiber Bi-Directional Media Converter modules extend the reach of short-range, multi-mode connections by using long-range, single-mode links over a single strand of fiber. Models are available with 20 kilometer and 40 kilometer transmission ranges.

Standard Gigabit CCM multi-mode ports provide minimum transmission distances of 220+ meters over 62.5/125 μm fiber or 500+ meters over 50.0/125 μm fiber.

- **Simple plug and go installation**
- **Transparent to Flow-Control commands such as PAUSE**
- **Uses Single-Fiber, single-mode connectors operating on 1550 ηm and 1310 ηm wavelengths**
- **Diagnostic and status LEDs**

Ordering Information

Model Numbers	Media Types	Min. Tx PWR	Max. Tx PWR	Rx Sensitivity	Min. PWR Budget	Max.PWR Budget	Max. Input PWR	Connector Type	Wavelengths (ηm)	Transmit Distance
CN converters with standard multi-mode fiber port connectors are designated by (CN-55XX) or (CCM-56XX) and have common power and sensitivity specifications. Standard single--mode fiber port connectors are designated by (-31-) e.g. (CN-XX31) or (CN-31XX)										
CN-5555 **	MM / MM	-9.5 dBm	-4.0 dBm	-17.0 dBm	7.5 dB	13.0 dB	0.0 dBm	SC/SC	850/850	220/550 m ea.
Specifications above in blue are for multi-mode, fiber connectors. Specifications below for single-mode fiber connectors										
CN-3131 **	SM / SM	-10.0 dBm	-3.0 dBm	-20.0 dBm	10.0 dB	17.0 dB	-3.0 dBm	SC/SC	1310/1310	10Km each
CN-5537A	MM / SM	-8.0 dBm	-3.0 dBm	-21.0 dBm	13.0 dB	18.0 dB	-3.0 dBm	SC/SC	1550/1310	550m / 20 Km
CN-5537B	MM / SM	-8.0 dBm	-3.0 dBm	-21.0 dBm	13.0 dB	18.0 dB	-3.0 dBm	SC/SC	1310/1550	550m / 20 Km
CN-5537E4A	MM / SM	-3.0 dBm	2.0 dBm	-23.0 dBm	20.0 dB	25.0 dB	-3.0 dBm	SC/SC	1550/1310	550m / 40 Km
CN-5537E4B	MM / SM	-3.0 dBm	2.0 dBm	-23.0 dBm	20.0 dB	25.0 dB	-3.0 dBm	SC/SC	1310/1550	550m / 40 Km
CN-3137A	SM / SM	-8.0 dBm	-3.0 dBm	-21.0 dBm	13.0 dB	18.0 dB	-3.0 dBm	SC/SC	1550/1310	10 Km / 20 Km
CN-3137B	SM / SM	-3.0 dBm	2.0 dBm	-23.0 dBm	20.0 dB	25.0 dB	-3.0 dBm	SC/SC	1310/1550	10 Km / 20 Km

** NOTE: CN Chassis converters are available as card modules designed for Canary's CCM-1600 Chassis models and as standalone units. Please refer to the CCM-1600 Data Sheets or Gigabit Ethernet Single-Fiber, Fiber-to-Fiber Data Sheet for additional information*

*** Reference optical specifications for standard multi-mode or single-mode fiber port connectors. Other table specifications for second (alternate) fiber port connector.*

More versions of the CN-5537A/B series may be found on the Canary web site as they become available.

Fast Ethernet Copper to Single-Fiber, Bi-Directional Single-Mode

CN-2047A/B – 100 Mbs UTP-to Fiber, Single Fiber Bi-Directional

Canary 100 Mbs UTP / Single-Fiber Media Converters are designed to link devices with RJ-45 ports to remote stations over a single strand of fiver optic cable. Models are available with 20, 40 and 60 kilometer transmission ranges. CN-2047A/B Media Converters are the first in the industry to speed-up Spanning Tree link recovery by employing Link Fault Signaling (LFS) technology while supporting Far-End Fault-Indication and parallel detection.

- **Switch for Hard-Setting Full-Duplex or 100BASE-T Autonegotiation for 100 Mbs, Full and Half-duplex operation**
- **Internal Auto-sensing, MDI / MDI-X crossover switch for proper Network Interface Card or Switch connections**
- **Switch enabled Link Fault Signaling (LFS) – Forwards lost link signals to each connected host**
- **Uses Single-Fiber, single-mode connectors operating on 1550 ηm and 1310 ηm wavelengths**
- **A full array of status / diagnostic LEDs**

Ordering Information

Model Numbers	Media Types	Min. Tx PWR	Max. Tx PWR	Rx Sensitivity	Min. PWR Budget	Max.PWR Budget	Max. Input PWR	Connector Type	Wavelengths (ηm)	Transmit Distance
CN-2047SA	UTP / SM	-14.0 dBm	-8.0 dBm	-33.0 dBm	19.0 dB	25.0 dB	-3.0 dBm	SC	1550/1310	20 Km
CN-2047SB	UTP / SM	-14.0 dBm	-8.0 dBm	-33.0 dBm	19.0 dB	25.0 dB	-3.0 dBm	SC	1310/1550	20 Km
CN-2047E4A	UTP / SM	-8.0 dBm	-3.0 dBm	-33.0 dBm	25.0 dB	30.0 dB	-3.0 dBm	SC	1550/1310	40 Km
CN-2047E4B	UTP / SM	-8.0 dBm	-3.0 dBm	-33.0 dBm	25.0 dB	30.0 dB	-3.0 dBm	SC	1310/1550	40 Km
CN-2047E6A	UTP / SM	-5.0 dBm	0.0 dBm	-33.0 dBm	28.0 dB	33.0 dB	-3.0 dBm	SC	1550/1310	60 Km
CN-2047E6B	UTP / SM	-5.0 dBm	0.0 dBm	-33.0 dBm	28.0 dB	33.0 dB	-3.0 dBm	SC	1310/1550	60 Km

** NOTE: CN Chassis Single-Fiber converters are available as card modules designed for Canary's CCM-1600 Chassis models and as standalone units. Please refer to the CCM-1600 Data Sheets or 100Mbs Single-Fiber, UTP-to-Fiber Data Sheet for additional information*

More versions of the CN-2047A/B series may be found on the Canary web site as they become available.

Fast Ethernet Duplex-Fiber to Single-Fiber Bi-directional Converters

CN-BXXXand CN-CXXX – 100 Mbs Fiber-to Fiber, Single Fiber Bi-Directional

Canary 100 Mbs Fiber/Single-Fiber Media Converter modules are designed to link short-range multi-mode segments via a single strand of single-mode fiber. Models are available with 20 kilometer, 40 kilometer and 60 kilometer transmission ranges. CN-C17SA/B and CN-C27SA/B Media Converters are the first in the industry to speed-up Spanning Tree link recovery by employing Link Fault Signaling (LFS) technology.

- **Simple plug and go installation**
- **Status / Diagnostic LED Indicators**
- **Automatic Link Fault Signaling (LFS) Forwards lost link signals to each connected host**
- **Uses Single-Fiber, single-mode connectors operating on 1550 ηm and 1310 ηm wavelengths**

Ordering Information

Model Numbers	Media Types	Min. Tx PWR	Max. Tx PWR	Rx Sensitivity	Min. PWR Budget	Max.PWR Budget	Max. Input PWR	Connector Type	Wavelengths (ηm)	Transmit Distance
CN-B113 **	MM / MM	-20.0 dBm	-14.0 dBm	-31.0 dBm	11.0 dB	17.0 dB	-8.0 dBm	SC/SC	1310/1310	2 Km Each
Specifications above in blue are for multi-mode, fiber connectors. Specifications below for single-mode, fiber connectors.										
CN-B9191 **	SM / SM	-15.0 dBm	-8.0 dBm	-34.0 dBm	19.0 dB	26.0 dB	-7.0 dBm	SC/SC	1310/1310	30 Km Each
CN-C17SA	MM / SM	-14.0 dBm	-8.0 dBm	-33.0 dBm	19.0 dB	25.0 dB	-3.0 dBm	SC/SC	1550/1310	20 Km
CN-C17SB	MM / SM	-14.0 dBm	-8.0 dBm	-33.0 dBm	19.0 dB	25.0 dB	-3.0 dBm	SC/SC	1310/1550	20 Km
CN-C17E4A	MM / SM	-8.0 dBm	-3.0 dBm	-33.0 dBm	25.0 dB	30.0 dB	-3.0 dBm	SC/SC	1550/1310	40 Km
CN-C17E4B	MM / SM	-8.0 dBm	-3.0 dBm	-33.0 dBm	25.0 dB	30.0 dB	-3.0 dBm	SC/SC	1310/1550	40 Km
CN-C17E6A	MM / SM	-5.0 dBm	0.0 dBm	-33.0 dBm	28.0 dB	33.0 dB	-3.0 dBm	SC/SC	1550/1310	60 Km
CN-C17E6B	MM / SM	-5.0 dBm	0.0 dBm	-33.0 dBm	28.0 dB	33.0 dB	-3.0 dBm	SC/SC	1310/1550	60 Km
CN-C27SA	SM / SM	-14.0 dBm	-8.0 dBm	-33.0 dBm	19.0 dB	25.0 dB	-3.0 dBm	ST/SC	1550/1310	20 Km
CN-C27SB	SM / SM	-14.0 dBm	-8.0 dBm	-33.0 dBm	19.0 dB	25.0 dB	-3.0 dBm	ST/SC	1310/1550	20 Km
CN-C27E4A	SM / SM	-8.0 dBm	-3.0 dBm	-33.0 dBm	25.0 dB	30.0 dB	-3.0 dBm	ST/SC	1550/1310	40 Km
CN-C27E4B	SM / SM	-8.0 dBm	-3.0 dBm	-33.0 dBm	25.0 dB	30.0 dB	-3.0 dBm	ST/SC	1310/1550	40 Km
CN-C27E6A	SM / SM	-5.0 dBm	0.0 dBm	-33.0 dBm	28.0 dB	33.0 dB	-3.0 dBm	ST/SC	1550/1310	60 Km
CN-C27E6B	SM / SM	-5.0 dBm	0.0 dBm	-33.0 dBm	28.0 dB	33.0 dB	-3.0 dBm	ST/SC	1310/1550	60 Km

** NOTE: CN Chassis Single-Fiber converters are available as card modules designed for Canary's CCM-1600 Chassis models and as standalone units. Please refer to the CCM-1600 Data Sheets or 100Mbs Single-Fiber, Fiber-to-Fiber Data Sheet for additional information*

*** Reference optical specifications for standard multi-mode or single-mode fiber port connectors. Other table specifications for second (alternate) fiber port connector.*

More versions of the CN-C72XA/B series may be found on the Canary web site as they become available.

NOTES:

(1) Fiber-to-Fiber Modules with two multi-mode fiber port connectors or two single-mode fiber port connectors are treated as Boosters and are designated by a (B) in the part number e.g. (CN-B113) or (CN-B9191).

(2) Modules with one multi-mode fiber port connector and one single-mode fiber port connector are treated as Converters and are designated by a (C) in the part number e.g. (CN-C113).

(3) The numeral (1) = SC type Fiber connectors and the numeral (2) = ST type Fiber connectors. For Converters, the first digit refers to the single-mode port and the second digit refers to the multi-mode port e.g. (CN-C123) = single-mode, SC Fiber, to multi-mode ST Fiber Converter.

(4) The last digit (3 or 5) refers to transmission wavelength i.e. 1310 nanometers or 1550 nanometers.

(5) A digit following capital (E) signifies Extended transmission distance e.g. (E8) = 80 Kilometers while (E4) = 40 Kilometers (recently increased to 50 Km).

CANARY communications

Coarse Wavelength Division Multiplexing

CWDM Multiplexer Modules and Media Converters

The CCN-2000/CCN-0400 Chassis Group includes Coarse Wavelength Division Multiplexer* modules and CWDM Media Converters. Canary Communications' approach to the CWDM solution is outlined below, followed by ordering information for CCN-2000/CCN-0400 Chassis Passive and Active Modules. Users who would like a Coarse Wavelength Division Multiplexing overview will find that discussion as one of the two appendices to this data-sheet. The other appendix provides Optical Insertion Loss tables and examples of Optical Insertion Loss calculations.

The Canary Communications Coarse Wavelength Division Multiplexing solution

Canary's approach to the CWDM marketplace and its deployment is derived from a simple premise based on the following **beliefs**:

- Any network using long distance single-mode fiber that needs more bandwidth can benefit by deploying CWDM Technology.
- Deploying and using CWDM Technology does not require "new", complex, "fully integrated" processor hardware with all the "bells and whistles".
- A basic CWDM installation can deliver most of the benefits of a much more complex one – at a much lower total cost of ownership.
- An experienced network administrator/integrator has the requisite skills to confidently deploy and use CWDM Technology.
- CWDM Technology does not mandate a rigid "one size fits all" mentality or approach to its deployment– it is modular, highly scalable, and is flexible enough to meet most user needs.

These beliefs led to the following **design principles**:

- If more single-mode bandwidth is needed, CWDM Technology is the solution.
- Deploying and using CWDM Technology does not have to be complex.
- Deploying and using CWDM Technology does not have to be expensive.
- Deploying and using CWDM Technology does not have to be difficult.
- CWDM Technology should be used when network scalability, flexibility, and cost are key.

NOTES

***Usage:** Throughout this document the acronym CWDM is used in two contexts: It encompasses Coarse Wavelength Division Multiplexing technology as a whole. Or more narrowly, it can refer to Coarse Wavelength Division Multiplexer/De-Multiplexer (mux/demux) hardware that optically combines transmitted wavelengths into a multiplexed data stream or partitions them, when received, into individual channels.

Coarse Wavelength Division Multiplexing

CWDM Multiplexer Modules and Media Converters

Canary's premise is that users can enjoy the full benefit of CWDM Technology, scaled to their exact needs, by using a simple, modular, building-block approach to its deployment. Canary's product development philosophy is to leverage the marketplace's familiarity and long experience with Media Converters and their use to make CWDM Technology understandable, easily deployable, and, above all, economical to use. Figures 1 and 2 illustrate typical installations.

Canary's CWDM product offering implements the above premises in the following ways:

1. Canary offers a wide range of Multiplexer/De-Multiplexer equipment with access capability for four, eight, and twelve user data-channels over duplex fiber, or four user channels over a single fiber strand. The Multiplexers are available in various form factors– standalone/rackable chassis and as slide-in modules for the Manageable multi-port CCN-2000/CCN-0400 and CCM-1600 Converter Chassis families.
2. Canary's selection of Optical Add/Drop Multiplexers (OADMs)* allows one, two, or four user-channels to exit and return to a CWDM data stream at intermediate locations on the fiber ring. One class of two channel OADMs enables newly inserted or channel return path data to propagate separately in two directions. The fiber segment is effectively split into two virtual segments at that point.
3. Active Media Converters are available to provide CWDM access for users with standard UTP or multi-mode Fiber connections, with CWDM transmitters providing several different power levels. Protocols supported by CWDM Conversion include Gigabit Ethernet, Fast Ethernet, and Fibre Channel.
4. Modular CWDM Converter cards are available for both the CCN-2000/CCN-0400 and CCM-1600 chassis families.
5. A CCN-2000/CCN-0400 and CCM-1600 chassis can be configured with one slide-in Multiplexer/De-Multiplexer Module and the needed Media Converter Modules to convert standard interfaces to CWDM wavelengths. The resulting package will operate as a self-contained unit.
6. Canary's CWDM Converter Modules are backward-compatible with older installed multi-port Converters. If a Canary multi-port chassis is already installed, upgrading to full CWDM capability is as simple as installing a Multiplexer Module and changing a few Converter Cards.

The Canary CWDM products that follow reflect and apply this efficient, cost-effective, and user-friendly design and development philosophy and approach.

Pages 20 through 30 provide ordering information for the following CCN-2000/CCN-0400 Chassis Group modules:

NOTES

*Detailed product information on Canary's Optical Add/Drop Multiplexer products can be found in the separate Coarse Wavelength Division Multiplexing data sheet included with this CD catalog.

Coarse Wavelength Division Multiplexing

Standard Four and Eight Channel Multiplexer/De-Multiplexer Modules

Canary's economical Coarse Wavelength Division Multiplexers (CWDMs) accomplish the process of combining and launching in parallel, multiple user data channels as a single, transmitted multi-wavelength data stream. The process uses completely passive, un-powered, optical components. In addition, CWDMs partition (de-mux) incoming multiplexed optical signals and distribute the individual traffic channels to their respective users. Standard Multiplexer/De-Multiplexer versions launch four and eight user-channels (wavelengths) across a single-mode duplex fiber segment. They are used in conjunction with specific Canary Media Converter models that provide *active* signal transmission using one of the eight defined CWDM wavelengths. They are also compatible with wavelength outputs from other CWDM-capable devices. It is important to insure that all interconnected CWDM devices, passive and active, be carefully matched as to wavelengths (channels) being allocated to specific user devices and their signal propagation paths across the fiber network. Keeping track of wavelength assignments is the sine qua non for successful CWDM installations.

Organizations deploying Coarse Wavelength Division Multiplexing technology are able to increase user access, add redundancy and reduce network congestion with a minimum infrastructure investment. With CWDM connections, multiple network users, subnets or VPNs can simultaneously access single-mode fiber links that were formerly limited to single Server and Switch backbone type connections.

Canary Coarse Wavelength Division Multiplexers are available as modules for both the CCN-2000 and CCM-1600 chassis media converter families and as Standalone, rackable versions.

Features include:

- Eight standard wavelengths available for standard single-mode fiber
- Four additional wavelengths (O-band) available for twelve channels
- Compatible with other vendor's CWDM transmitters
- Compatible with chassis-based CWDM modules
- Client ports use LC connectors
- Economical and flexible network installations
- No power required for operation
- Transparent to protocol type
- Simple plug and go installation

Please refer to Figures 1 and 2 for a generalized view of connection layouts using Multiplexer / De-Multiplexers and Optical Add Drop Multiplexers (OADMs) for user access at intermediate locations. Canary's OADMs enable selected channel wavelengths to "Drop" (exit) and be "Added" (re-inserted) into a multi-wavelength, single-mode data stream – this allows intermediate locations between host sites to access the common, point-to-point fiber segment linking them. Detailed OADM information is provided by the CWDM data sheet.

NOTES

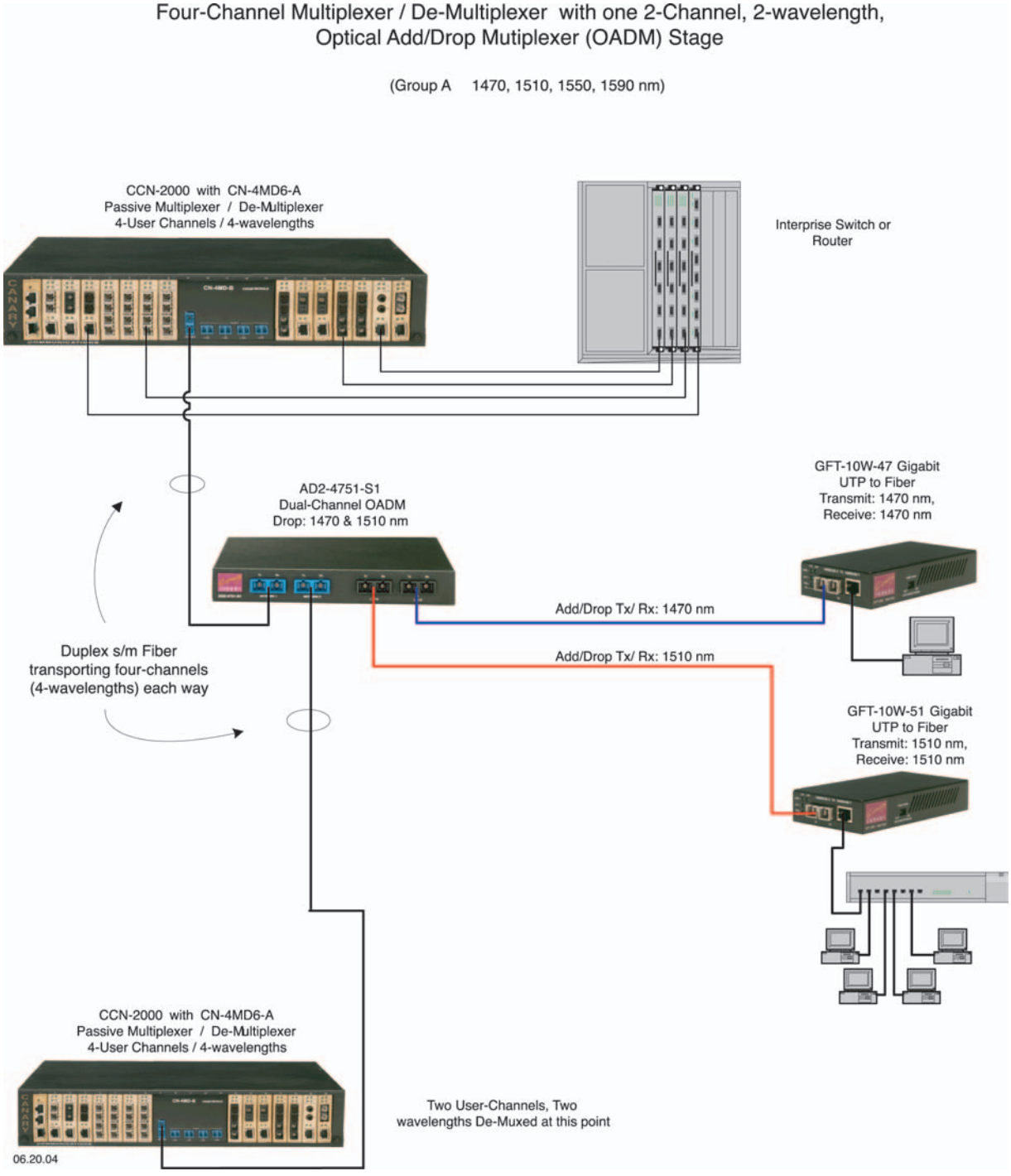
1. It is recommended that Canary passive CWDM multiplexer/de-multiplexer and OADM devices only be paired with other Canary passive CWDM devices for proper functioning. This is necessary in order to balance end-to-end Optical Insertion Losses across all multiplexed wavelengths. Outgoing (traffic) CWDM wavelengths are internally combined in a certain sequence during the multiplexing stage, with the first inserted wavelength subject to proportionally greater Optical Loss than the last wavelength inserted. The incoming multiplexed data stream at the remote site is separated and distributed in the same order sequence during the de-multiplexer stage. Thus the first wavelength de-muxed incurs a lower loss than the last wavelength de-muxed. This paired arrangement proportionally matches high losses accrued during the mux stage per wavelength with low losses incurred during the de-mux stage – in the process balancing end-to-end Optical Insertion Losses across all wavelengths. Canary Optical Add/Drop Multiplexers (OADMs) that drop and insert more than one wavelength are subject to the same phenomena and are handled in a similar fashion.

2. Optical Attenuators may need to be installed to avoid overdriving the *active* CWDM transceivers if the fiber span is too short. Optical Insertion Loss tables to be used for calculating accumulated device Losses are included in the final section of this data sheet as well as sample Insertion Loss calculation examples. Please refer to the Optical Insertion Loss Table (I-2) for reference.

3. Before placing an order for Passive and Active CWDM components, an end-to-end network Power Budget Calculation should be completed that includes the additional device Optical Losses incurred when deploying CWDM Multiplexer/De-Multiplexers and OADMs. An accurate estimate of the total expected optical power losses will help in the proper selection of Active CWDM Converters/ Transceivers providing the correct output power ranges. Table I-2 in the Appendix lists the path Optical Insertion Losses through each class of Canary Multiplexer / De-Multiplexers. These values should be used when estimating the combined Optical Power losses that will accrue when deploying CWDM equipment.

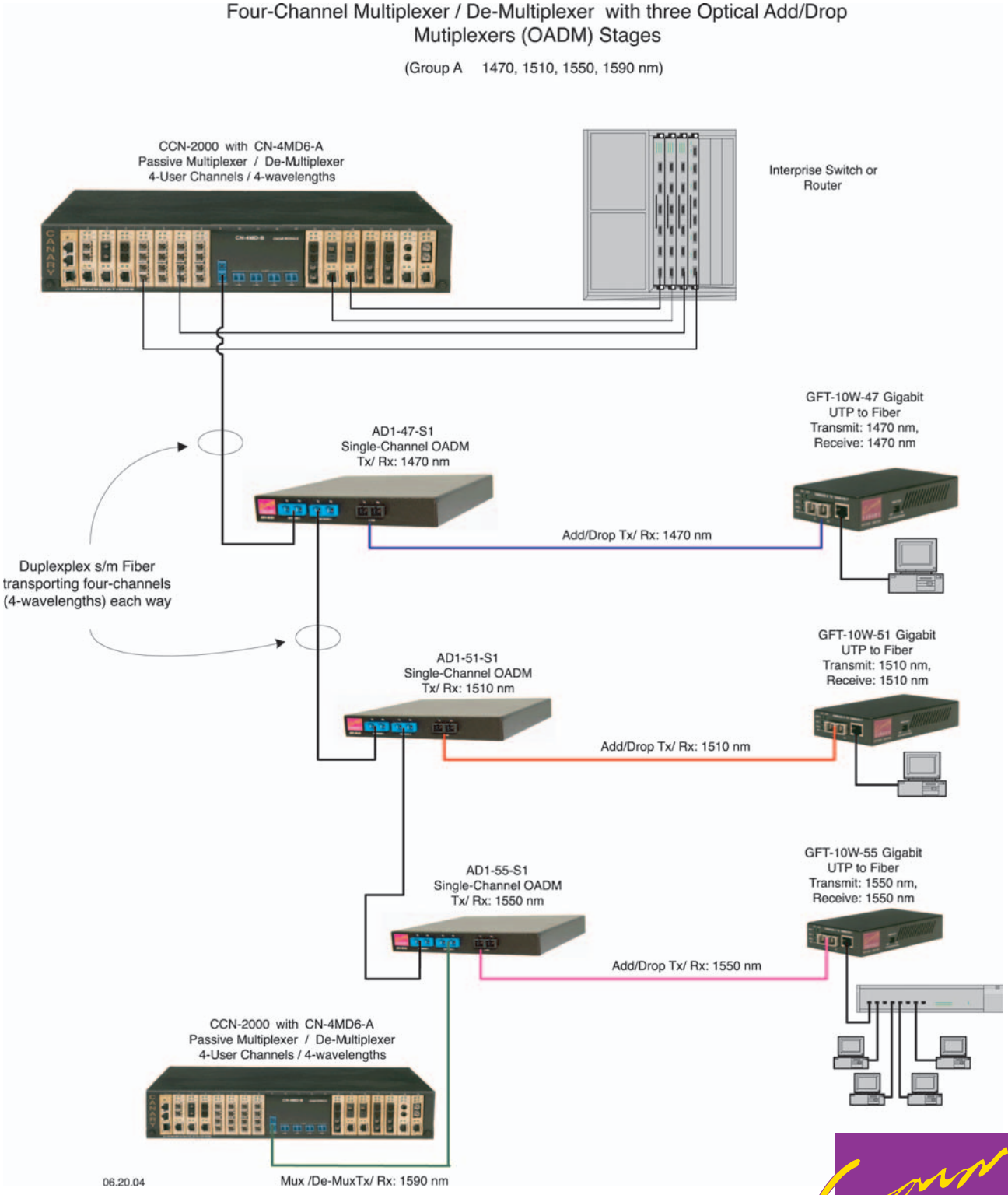
CWDM Modules and Converters

Figure 1



CWDM Modules and Converters

Figure 2



Coarse Wavelength Division Multiplexing

Single-Fiber, Bi-Directional CWDM Multiplexer/De-Multiplexers

Single-Fiber, Bi-Directional Multiplexer/De-Multiplexer versions transport four user-channels across a simplex, (single-fiber) single-mode strand. Each of the four user-channels employs two wavelengths – one for outgoing data transmission and one for incoming data reception. In practice, eight wavelengths are paired in use and require two variants of Single-Fiber Multiplexer /De-multiplexers to be linked as complementary pairs. One Single-Fiber variant (SFA) transmits on Group-A wavelengths (λs) and receives on Group-B wavelengths. The other variant (SFB) transmits on Group-B wavelengths and receives on Group-A wavelengths. Together, they form a complementary pair. One SFA version must always be connected to one SFB version for the proper functioning of Single-Fiber, Bi-Directional links. CCN-2000 SFA units can function with any other standalone or CCM-1600 chassis based SFB Multiplexers and visa versa. Single-Fiber multiplexers are ideal for maintaining or increasing user access when available fiber is limited to a single strand or is being redeployed for other uses.

Canary Single-Fiber, Bi-Directional Coarse Wavelength Division Multiplexers use completely passive, un-powered, optical components and are available as modules for both the CCN-2000 and CCM-1600 chassis media converter families and as standalone versions.

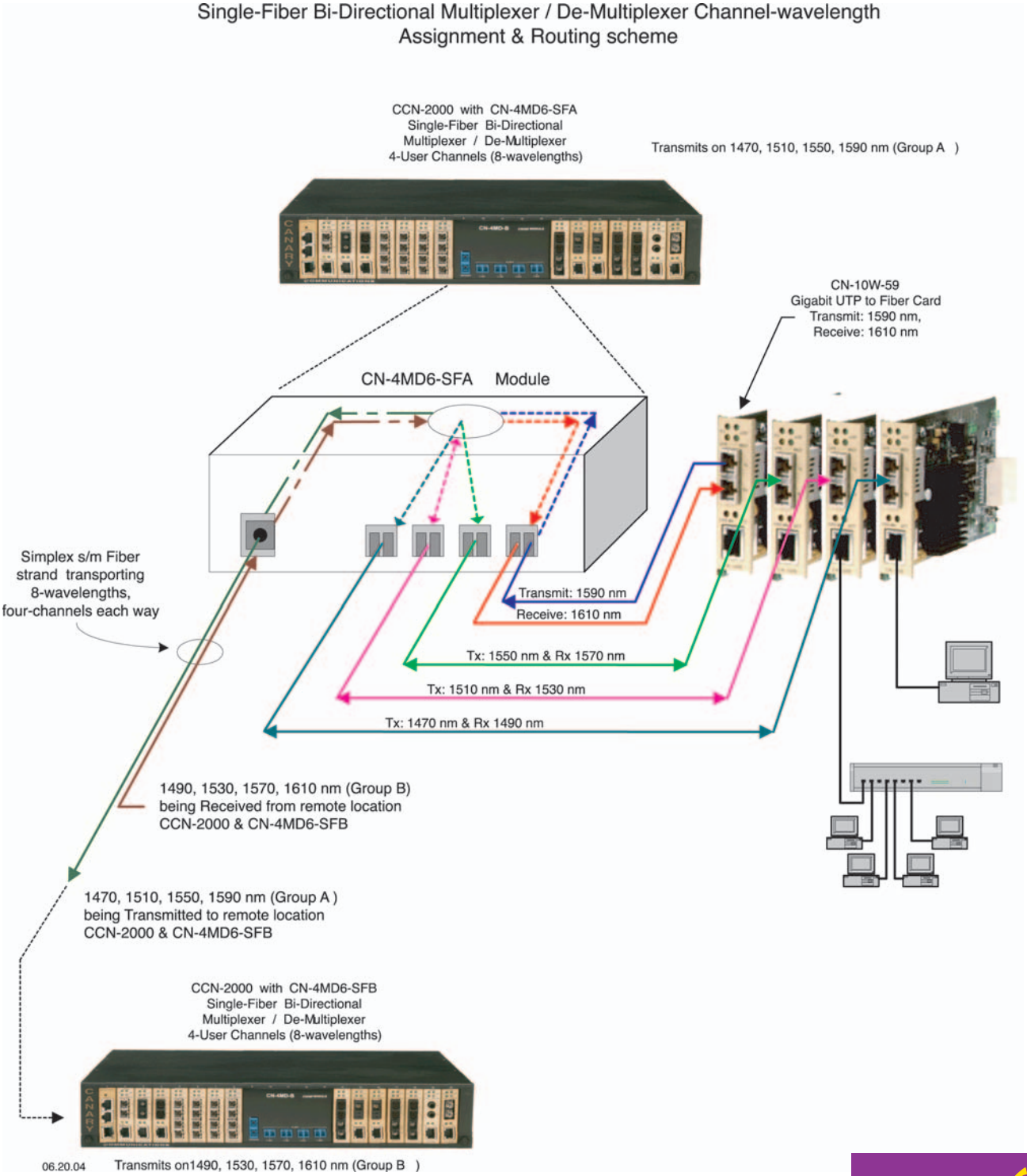
Please refer to Figure 3 to view a Single-Fiber Bi-Directional connection scheme.

- **Four user channels supported over a single fiber strand**
- **Compatible with other vendor's CWDM transmitters**
- **Connects with chassis-based CWDM modules**
- **Economical and flexible network installations**
- **Helps conserve limited fiber infrastructure**
- **No power required for operation**
- **Transparent to protocol type**
- **Simple plug and go installation**

CWDM Modules and Converters

Figure 3

Single-Fiber Bi-Directional Multiplexer / De-Multiplexer Channel-wavelength Assignment & Routing scheme



Chassis CWDM Multiplexer/Demultiplexer Modules

CN-XMD6-X – Passive Optical CWDM Multiplexer/Demultiplexer Modules

Ordering Information

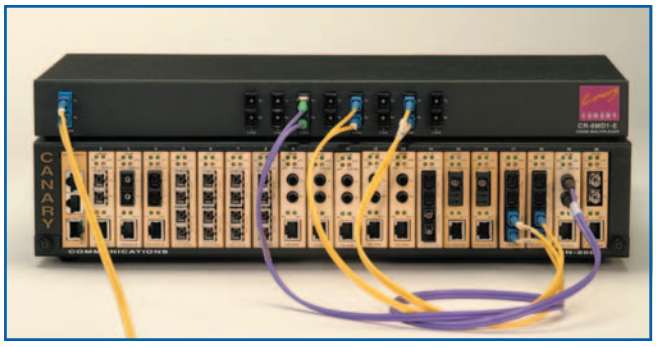
Model Numbers	Description	ITU-CWDM Wavelengths (λ) in nano- meters (ηm)	Power Source	Shipping Weight
CCN-2000	20-Slot chassis + single AC Power Supply	N/A	100/240VAC	14.0 lb (6.2 Kg)
CN-4MD6-A	4-Channel Mux/Demux, Group A λs (LC clients)	1470, 1510, 1550, 1590	None	1.8 lb (0.8 Kg)
CN-4MD6-B	4-Channel Mux/Demux, Group B λs (LC clients)	1490, 1530, 1570, 1610	None	1.8 lb (0.8 Kg)
CN-4MD6-C	4-Channel Mux/Demux, Group C λs (LC clients)	1290, 1310, 1330, 1350	None	1.8 lb (0.8 Kg)
CN-4MD6-D	4-Channel Mux/Demux, Group D λs (LC clients)	1390, 1410, 1430, 1450	None	1.8 lb (0.8 Kg)
CN-4MD6-M	4-Channel Mux/Demux, Group M λs (LC clients)	1310, 1330, 1350, 1370	None	1.8 lb (0.8 Kg)
CN-4MD6-SFA *	4-Channel Mux/Demux, Single-Fiber Bi-Directional	TX: 1470, 1510, 1550, 1590 RX: 1490, 1530, 1570, 1610	None	1.8 lb (0.8 Kg)
CN-4MD6-SFB *	4-Channel Mux/Demux, Single-Fiber Bi-Directional	TX: 1490, 1530, 1570, 1610 RX: 1470, 1510, 1550, 1590	None	1.8 lb (0.8 Kg)
CN-8MD6-E	8-Channel Mux/Demux, Group E λs (LC clients)	1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610	None	1.8 lb (0.8 Kg)
CN-8MD6-F	8-Channel Mux/Demux, Group F λs (LC clients)	1290, 1310, 1330, 1350, 1390, 1410, 1430, 1450	None	1.8 lb (0.8 Kg)
CN-8MD6-M	8-Channel Mux/Demux, Group M λs (LC clients)	1310, 1330, 1350, 1370, 1390, 1410, 1430, 1450	None	1.8 lb (0.8 Kg)
CBL-SM-1/6	12-inch s/m Fiber jumper cable (SC/LC): Couples Optical output from Chassis active CWDM transceivers to passive Multiplexer/De-Multiplexer module (LC) ports. One cable required for each active CWDM data channel.		N/A	0.8 lb (0.4 Kg)

** Single-Fiber Bi-Directional, 4-channel Multiplexer/De-Multiplexers must be connected as complementary SFA & SFB pairs i.e. one SFA unit must be connected with one SFB unit to establish a proper, functioning data link across the single-mode fiber trunk-cable.*

There are eighteen CWDM wavelengths (λs) specified. Eight standard wavelengths plus four O-band λs are useable over most standard single-mode fiber. Canary offers products for the standard eight wavelengths plus four O-band λs: 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610 ηm + 1290, 1310, 1330, 1350 ηm

NOTE: CN-XMD6-X chassis Multiplexer / De-multiplexer modules are available as Standalone / Rackable (CR) units or as modules for the 16-slot CCM-1600 chassis group.

Please refer to other CWDM product data pages for additional information.



Illustrated: CCN-2000 with CR-8MD1 and cabling

Passive Multiplexer Module Specifications

Power Supply:

- None required for Multiplexing and De-Multiplexing *Passive* Optical Modules

Mechanical:

Mulitplexer and De-Multiplexer Modules

- Height: 2.9" (7.2 cm)
- Width: 4.0" (10.2 cm)
- Covers 5 slots ... 15 active slots remain

Environmental:

- Operating Temp.: 0 to 49°C
- Storage Temp.: -10 to 66°C
- Relative Humidity: 5% to 95% non-condensing

Gigabit Ethernet UTP-to-Fiber CWDM Converters

CN-10W-XX *– Gigabit UTP-to-Fiber Media Converters with Single-mode ITU specified CWDM wavelengths*

Illustrated: CCN-2000 with CN-8MD-E CWDM module

Canary's CN-10W-XX series of Gigabit Coarse Wavelength Division Multiplexing (CWDM) Media Converters make the transitions from copper to fiber easy. They provide an economical way to launch Gigabit Ethernet data for transport through CWDM Multiplexers and provide access to high capacity CWDM based networks. CN-10W-XX CWDM Converters function identically to units with standard fiber connectors.

- 1000BASE-T Autonegotiation for Full-duplex and Half-duplex operation with Flow-Control and;
- Switch selectable, Fiber-Port Autonegotiation for common, end-to-end link awareness and Flow-Control, or for independent connection to Gigabit fiber ports on older switches
- Internal Auto-sensing, MDI / MDI-X crossover switch for Network Interface Card or Switch connections
- Transmits individual ITU specified CWDM wavelengths
- 1000BASE-z Fiber Specifications
- Transparent to Flow-Control commands such as PAUSE
- A full array of status / diagnostic LEDs

Ordering Information

Model Numbers	Media Types	Min. Tx PWR	Max. Tx PWR	Rx Sensitivity	Min. PWR Budget	Max.PWR Budget	Max. Input PWR	Connector Type	Wavelengths (ηm)	Transmit Distance
CN-10W-XX *	UTP / SM	-5.0 dBm	0.0 dBm	-22.0 dBm	17.0 dB	22.0 dB	-3.0 dBm	SC	1470 - 1610	40 Km
CN-10W-XXE6	UTP / SM	0.0 dBm	5.0 dBm	-24.0 dBm	24.0 dB	29.0 dB	-3.0 dBm	SC	1470 - 1610	60+ Km
CN-10W-XXE8	UTP / SM	dBm	dBm	dBm	dB	dB	dBm	SC	1470 - 1610	80 Km

** NOTE 1: W-XX designates one of eighteen CWDM optical transmission wavelengths (λ) e.g. CN-10W-47 = 1470 ηm or CN-10W-61 = 1610 ηm transmission.Please refer to other CWDM (Coarse Wavelength Division Multiplexing Data Sheets for additional information.*

** NOTE 2: Gigabit CN-10W-XX converters are available as standalone units or as card modules designed for the CCM-1600 chassis. Please refer to the Gigabit GFT-10XX, UTP-to-Fiber CWDM Data Sheet or the CCM-1600 Data Sheets for additional information.*

There are eighteen CWDM wavelengths (λs) specified. Eight standard wavelengths plus four O-band λs are useable over most standard single-mode fiber.
Canary offers products for the standard eight wavelengths plus four O-band λs: 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610 ηm + 1290, 1310, 1330, 1350 ηm

Temperature Dependence of Active CWDM Transmitter Center Wavelengths ≤ 0.08 ηm per degree C

More versions of the CN-10W-XX series may be found on the Canary web site as they become available.

Gigabit Ethernet Fiber-to-Fiber CWDM Converters

CN-55W-XX – Gigabit Fiber-to-Fiber Converters with Single-mode ITU specified CWDM wavelengths

Canary's CN-55W-XX series of Gigabit Coarse Wavelength Division Multiplexing (CWDM) Media Converters provide an economical way to convert multi-mode Gigabit data to CWDM wavelengths for launch and transport through CWDM Multiplexers and provide access to high capacity CWDM based networks. CN-55W-XX CWDM converters function identically to units with standard fiber connections. Standard multi-mode fiber connectors on CN-55W-XX modules provide minimum transmission of 220+ meters over 62.5 μm fiber or 500+ meters over 50.0 μm fiber.

- **1000BASE-SX Multi-mode Connection**
- **Simple plug and go installation**
- **Status / Diagnostic LED Indicators**
- **Transparent to Flow-Control commands such as PAUSE**
- **Transmits individual ITU specified CWDM wavelengths**
- **1000BASE-z Fiber Specifications**

Ordering Information

Model Numbers	Media Types	Min. Tx PWR	Max. Tx PWR	Rx Sensitivity	Min. PWR Budget	Max.PWR Budget	Max. Input PWR	Connector Type	Wavelengths (ηm)	Transmit Distance
Gigabit converters with standard multi-mode fiber port connectors are designated by (CN-55XX) or (CCM-56XX) and have common power and sensitivity specifications										
CN-5555 **	MM / MM	-9.5 dBm	-4.0 dBm	-17.0 dBm	7.5 dB	13.0 dB	0.0 dBm	SC/SC	850/850	220/550 m ea.
Specifications above in blue are for multi-mode, fiber connectors. Specifications below for single-mode CWDM fiber connectors										
CN-55W-XX *	MM / SM	-5.0 dBm	0.0 dBm	-22.0 dBm	17.0 dB	22.0 dB	-3.0 dBm	SC/SC	1470 - 1610	550m / 40 Km
CN-55W-XE6	MM / SM	0.0 dBm	5.0 dBm	-24.0 dBm	24.0 dB	29.0 dB	-3.0 dBm	SC/SC	1470 - 1610	550m / 60 Km
CN-55W-XE8	MM / SM	dBm	dBm	dBm	dB	dB	dBm	SC/SC	1470 - 1610	550m / 80 Km

** NOTE 1: W-XX designates one of eighteen CWDM optical transmission wavelengths (λ) e.g. CN-55W-47 = 1470 ηm or CN-55W-61 = 1610 ηm transmission. Please refer to the CWDM (Coarse Wavelength Division Multiplexing Sections for more information.*

** NOTE 2: CN-55W-XX converter cards are available as card modules designed for Canary's 16-slot, unmanaged CCM-1600 Chassis models and as standalone units. Please refer to the CCM-1600 Data Sheets or GFC-55W-XX CWDM Data Sheet for additional information.*

*** Reference optical specifications for standard multi-mode or single-mode fiber port connectors. Other table specifications for second (alternate) fiber port connector.*

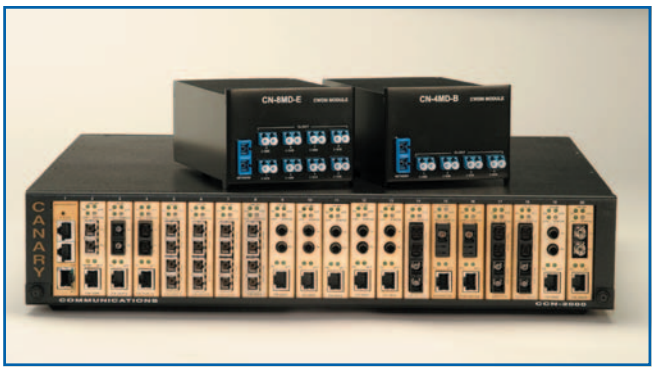
There are eighteen CWDM wavelengths (λs) specified. Eight standard wavelengths plus four O-band λs are useable over most standard single-mode fiber. Canary offers products for the standard eight wavelengths plus four O-band λs: 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610 ηm + 1290, 1310, 1330, 1350 ηm

Temperature Dependence of Active CWDM Transmitter Center Wavelengths ≤ 0.08 ηm per degree C

More versions of the CN-55W-XX series may be found on the Canary web site as they become available.

Fast Ethernet UTP-to-Fiber CWDM Converters

CN-12W-XX – 100 Mbs UTP-to-Fiber Converters with Single-mode ITU specified CWDM wavelengths



Illustrated: CCN-2000 chassis with CWDM modules

CN-12W-XX Fast Ethernet UTP-to-Fiber CWDM Media Converters provide economical access to CWDM based networks. They are based on standard 100 Megabit units that are the first in the industry to speedup Spanning Tree link recovery by employing Link Fault Signaling (LFS) technology. They also support Far-End Fault-Indication and parallel detection.

- Switch for Hard-Setting Full-Duplex or 100BASE-TX Autonegotiation for 100 Mbs, Full and Half-duplex operation
- Internal Auto-sensing, MDI / MDI-X crossover switch for proper Network Interface Card or Switch connections
- Switch enabled Link Fault Signaling (LFS) – Forwards lost link awareness to each connected host
- Transmits individual ITU specified CWDM wavelengths
- 100BASE-TX UTP Specifications
- A full array of status / diagnostic LEDs

Ordering Information

Model Numbers	Media Types	Min. Tx PWR	Max. Tx PWR	Rx Sensitivity	Min. PWR Budget	Max.PWR Budget	Max. Input PWR	Connector Type	Wavelengths (ηm)	Transmit Distance
CN-20W-XX	UTP / SM	-5.0 dBm	0.0 dBm	-34.0 dBm	29.0 dB	34.0 dB	-3.0 dBm	SC	1470 - 1610	80 Km
CN-20W-XXE9	UTP / SM	-3.0 dBm	2.0 dBm	-34.0 dBm	31.0 dB	36.0 dB	-3.0 dBm	SC	1470 - 1610	100 Km

** NOTE 1: W-XX designates one of eighteen CWDM optical transmission wavelengths (λ) e.g. CN-20W-47 = 1470 ηm or CN-20W-61 = 1610 ηm transmission.Please refer to the 100 Mbs UTP-to-Fiber CWDM (Coarse Wavelength Division Multiplexing Data Sheet for additional information.*

** NOTE 2: CN Chassis CWDM converters are available as card modules designed for Canary's unmanaged CCM-1600 Chassis models and as standalone units. Please refer to the Data Sheets or CFT-20XX 100Mbs UTP-to-Fiber CWDM Data Sheet for additional information*

There are eighteen CWDM wavelengths (λ.s) specified. Eight standard wavelengths plus four O-band λs are useable over most standard single-mode fiber. Canary offers products for the standard eight wavelengths plus four O-band λs: 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610 ηm + 1290, 1310, 1330, 1350 ηm

Temperature Dependence of Active CWDM Transmitter Center Wavelengths ≤ 0.08 ηm per degree C

More versions of the CN-20W-XX series may be found on the Canary web site as they become available.

Fast Ethernet Fiber-to-Fiber CWDM Converters

CN-XXW-XX – 100 Mbs Fiber-to-Fiber Converters with Single-mode ITU specified CWDM wavelengths

Canary's CN-XXW-XX Fiber-to-Fiber CWDM Media Converter modules economically transmit Fast Ethernet fiber data to CWDM multiplexers for transport throughout the network. Standard module interfaces include multi-mode and single-mode, with SC and ST connector types. Canary's Fiber-to-Fiber Converters were the first in the industry to speedup Spanning Tree link recovery by employing Link Fault Signaling (LFS) technology that forwards lost link signals to each connected host.

- **Simple plug and go installation**
- **Status / Diagnostic LED Indicators**
- **Transmits individual ITU specified CWDM wavelengths**
- **100 BASE-FX Fiber Specifications**
- **Automatic Link Fault Signaling (LFS) Forwards lost link awareness to each connected host**

Ordering Information

Model Numbers	Media Types	Min. Tx PWR	Max. Tx PWR	Rx Sensitivity	Min. PWR Budget	Max.PWR Budget	Max. Input PWR	Connector Type	Wavelengths (ηm)	Transmit Distance
CN-B113 **	MM / MM	-20.0 dBm	-14.0 dBm	-31.0 dBm	11.0 dB	17.0 dB	-8.0 dBm	SC/SC	1310/1310	2 Km Each
Specifications above in blue are for multi-mode, fiber connectors. Specifications below for single-mode fiber connectors										
CN-B9191 **	SM / SM	-15.0 dBm	-8.0 dBm	-34.0 dBm	19.0 dB	26.0 dB	-7.0 dBm	SC/SC	1310/1310	30 Km Each
CN-C11W-XX	MM / SM	-5.0 dBm	0.0 dBm	-34.0 dBm	29.0 dB	34.0 dB	-3.0 dBm	SC/SC	1470 - 1610	2Km / 80 Km
CN-C11W-XXE9	MM / SM	-3.0 dBm	2.0 dBm	-34.0 dBm	31.0 dB	36.0 dB	-3.0 dBm	SC/SC	1470 - 1610	2Km / 100Km

NOTE 1: W-XX designates one of eighteen CWDM optical transmission wavelengths (λ) e.g. CN-C11W-47 = 1470 ηm or CN-C11W-61 = 1610 ηm transmission. Please refer to other CWDM Coarse Wavelength Division Multiplexing Data Sheets for additional information.

NOTE 2: CN Chassis CWDM converters are available as card modules designed for Canary's unmanaged CCM-1600 Chassis models and as standalone units. Please refer to the CCM-1600 Data Sheets or 100Mbs Fiber-to-Fiber CWDM Data Sheet for additional information

*** Reference optical specifications for standard multi-mode or single-mode fiber port connectors. Other table specifications are for second (alternate) CWDM fiber port connector.*

There are eighteen CWDM wavelengths (λs) specified. Eight standard wavelengths plus four O-band λs are useable over most standard single-mode fiber. Canary offers products for the standard eight wavelengths plus four O-band λs: 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610 ηm + 1290, 1310, 1330, 1350 ηm

Temperature Dependence of Active CWDM Transmitter Center Wavelengths ≤ 0.08 ηm per degree C

More versions of the CN-C11W-XX series may be found on the Canary web site as they become available.

NOTES:

(1) Fiber-to-Fiber Modules with two multi-mode fiber port connectors or two single-mode fiber port connectors are treated as Boosters and are designated by a (B) in the part number e.g. (CN-B113) or (CN-B9191).

(2) Modules with one multi-mode fiber port connector and one single-mode fiber port connector are treated as Converters and are designated by a (C) in the part number e.g. (CN-C113).

(3) The numeral (1) = SC type Fiber connectors and the numeral (2) = ST type Fiber connectors. For Converters, the first digit refers to the single-mode port and the second digit refers to the multi-mode port e.g. (CN-C123) = single-mode, SC Fiber, to multi-mode ST Fiber Converter.

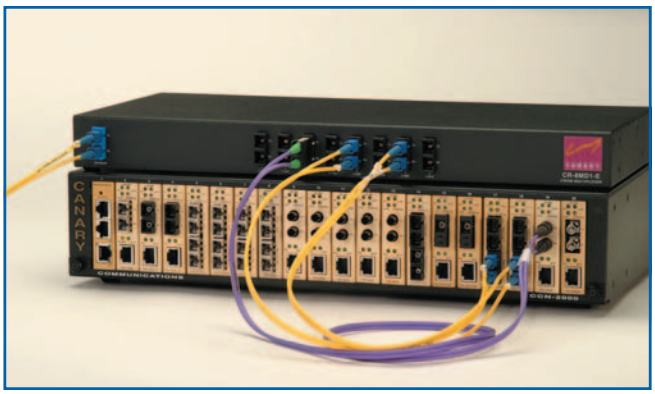
(4) The last digit (3 or 5) refers to transmission wavelength i.e. 1310 nanometers or 1550 nanometers.

(5) A digit following capital (E) signifies Extended transmission distance e.g. (E9) = 100 Kilometers.

Appendices

Coarse Wavelength Division Multiplexing Overview

Optical Insertion Losses and Calculation examples



Illustrated: CCN-2000 connected to CWDM Multiplexer

Coarse Wavelength Division Multiplexing

Overview

Why Coarse Wavelength Division Multiplexing?

Coarse Wavelength Division Multiplexing (CWDM)* is a technology that increases the data carrying capacity or bandwidth of single-mode fiber by transporting multiple wavelengths (lambdas) in parallel over it, each wavelength carrying a discrete user data channel. The technique employs completely passive devices that (on one end) optically combine and launch multiple wavelength data channels, and (on the other end) recovers, partitions and distributes them to their respective user destinations. Commonly, eight discrete wavelengths, one lambda (λ) per channel, are used to access existing single-mode links at this time.

CWDM Technology increases user access to existing installed fiber, offers greater system redundancy, and reduces network congestion with a minimum infrastructure investment. With CWDM connections, multiple network users, subnets, or VPNs can access and traverse single-mode links that were formerly limited to single user, Server and Switch backbone-type connections.

There are eighteen unique, ITU-defined CWDM wavelengths available for Gigabit Ethernet and other high-speed protocols. Currently, there are eight ITU CWDM wavelengths available for transmission of Gigabit Ethernet, Fibre Channel and Fast Ethernet over standard SMF-28 type single-mode fiber, with an additional four (O-Band) wavelengths also useable. The remaining wavelengths are subject to excessive optical attenuation over standard single-mode fiber and require the use of special low water-peak (low hydroxyl ion) fiber.

The eighteen wavelengths of the CWDM spectrum are optically separated by twenty nanometers (ηm) spacing. This spacing ensures that correct channel separation is maintained between connected devices even though the transmitter elements are un-cooled and the ambient transmitter temperatures vary across the normal 70ºC network range. In this environment, current technology makes it possible for wavelengths to not drift more than 0.1 ηm/degree C, and with 20 ηm channel spacing, maintains sufficient margin for proper channel separation.

Advantages of CWDM vs. DWDM (Dense Wavelength Division Multiplexing) technology

CWDM has the advantages of less complexity, lower installed and total lifetime cost of ownership, and relatively simple installation; it has lower power and cooling requirements, and is optimized for mid-range (40 to 80+ kilometers) metro and campus networks. CWDM is limited to a maximum of twelve channels over standard SMF-28 type single-mode fiber, and up to eighteen channels if using low attenuation (low water-peak) single-mode fiber. Nevertheless, an eight, twelve, or eighteen fold increase in Fiber bandwidth represents a huge increase in available transmission capacity over traditional approaches, with minimal infrastructure investment.

DWDM has the potential advantage of many more (120 or more tightly-spaced channels) over single-mode fiber, has potentially much greater transmission range, operates over a narrow band (C and L-bands) of light frequencies with outputs ranging between 1530 and 1620 ηm, can be used in the metro space, and can be configured for long-haul applications. There is also considerable field experience in deploying DWDM systems. However, these advantages come with the serious penalties of greater system complexity and much higher initial and lifetime system and manpower costs. These costs are due to the following requirements: The installation on each transmitter module of Peltier Effect Thermal Electric Coolers (TECs) and associated control circuitry needed for precise wavelength management, more powerful laser transceivers with sensitive (expensive) avalanche photo-diode (APD) receivers, greater system power and cooling requirements, erbium doped fiber amplifiers (EDFAs) to boost long range transmission power, more complex passive optics (that have to contend with very narrow wavelength spacing, pass-band power-leveling, four-wave mixing, polarization mode dispersion etc.), and a much larger spare parts inventory.

DWDM potentially offers much greater bandwidth but the initial start-up and life-cycle costs are daunting and significantly greater than those required for a full-featured, high-bandwidth CWDM solution.

NOTES

***Usage:** Throughout this document the acronym CWDM is used in two contexts: It encompasses Coarse Wavelength Division Multiplexing technology as a whole. Or more narrowly, it can refer to Coarse Wavelength Division Multiplexer/De-Multiplexer (mux/demux) hardware that optically combines transmitted wavelengths into a multiplexed data stream or partitions them, when received, into individual channels.

Optical Isolation Values

As noted earlier, optical insertion losses are an important consideration when planning for and ordering passive and active CWDM components.

The following table is for reference only. It lists the (path) Optical Isolation values through each class of Canary (four & eight channel) Multiplexer / De-Multiplexers and OADMs that service one, two and four Client access-channel "Drops" & "Adds".

Table (I-1)

Model Numbers	Descriptions (OADMs & Multiplexer / De-Multiplexers)	Optical Isolation for each Multiplexer/De-Multiplexer stage (Minimum)	Optical Isolation Per OADM Drop point (Minimum)	Optical Isolation Per OADM Add point (Minimum)	Optical Isolation Per OADM Pass-Thru point (Minimum)
CN-4MD6-A /B	4-Channel Mux/Demux Groups A or B λ.s (Wavelengths)	> 30.0 dB each	Not Applicable	Not Applicable	Not Applicable
CN-4MD6-SFA*	4-Channel Mux/Demux Single-Fiber, Bi-Directional, TX: Grp. A λ.s, RX: Grp. B λ.s	> 30.0 dB each	Not Applicable	Not Applicable	Not Applicable
CN-4MD6-SFB*	4-Channel Mux/Demux Single-Fiber, Bi-Directional, TX: Grp. B λ.s, RX: Grp. A λ.s	> 30.0 dB each	Not Applicable	Not Applicable	Not Applicable
CN-8MD6-E/F	8-Channel Mux/Demux Groups E or F λ.s (Wavelengths)	> 30.0 dB each	Not Applicable	Not Applicable	Not Applicable
The following Optical Add/Drop Multiplexer (OADM) entries are included for reference. Details of their use may be found in the CWDM Passive Multiplexer/De-Multiplexer data sheets					
AD1-47-S1 thru AD1-61-S1	1-Channel OADM, 1-λ One SC Client-Add/Drop port	Not Applicable	> 30.0 dB	> 30.0 dB	> 25.0 dB
AD2-47-S1 thru AD2-61-S1	2-Channel OADM, 1-λ Two SC Client-Add/Drop ports	Not Applicable	> 30.0 dB	> 30.0 dB	> 25.0 dB
AD2-4751-S1 thru AD2-5761-S1	2-Channel OADM, 2-λ.s Two SC Client-Add/Drop ports	Not Applicable	> 30.0 dB	> 30.0 dB	> 25.0 dB
AD4-4A-S1 and AD4-4B-S1	4-Channel OADM, 4-λ.s Four SC Client-Add/Drop ports	Not Applicable	> 30.0 dB	> 30.0 dB	> 12.5 dB

** Single-Fiber Bi-Directional, 4-channel Multiplexer/De-Multiplexers must be connected as complementary SFA & SFB pairs i.e. one SFA unit must be connected with one SFB unit to establish a proper, functioning data link across the single-mode fiber cable.*

All models of Passive Multiplexer / De-Multiplexers & OADMs use SC connectors as standard for single-mode network (loop) connections. Client ports are SC style fiber connectors.

There are eighteen CWDM wavelengths (λ.s) specified. Eight standard wavelengths plus four O-band λ.s are useable over most standard single-mode fiber. Canary offers products for the standard eight wavelengths plus four O-band λ.s e.g. 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610 ηm + 1290, 1310, 1330, 1350 ηm

Optical Insertion Losses

This section presents Optical Insertion Loss values, and demonstrates their use in Optical Loss Budget calculations.

The Optical Insertion Loss examples included herein only consider the accumulated Insertion Losses that are contributed by the equipment supplied by Canary Communications when deploying CWDM Multiplexer/De-Multiplexers and OADMs in a network. A complete Optical Budget for the entire network should be calculated separately.

The following table lists the (path) Optical Insertion Losses through each class of Canary (four & eight channel) Multiplexer / De-Multiplexers and OADMs that service one, two and four Client access-channel "Drops" & "Adds". The tabulated Insertion Loss values are used for estimating the combined Optical Power Losses incurred by an optical signal traversing a series of Passive CWDM Multiplexer or OADM stages.

Table (I-2)

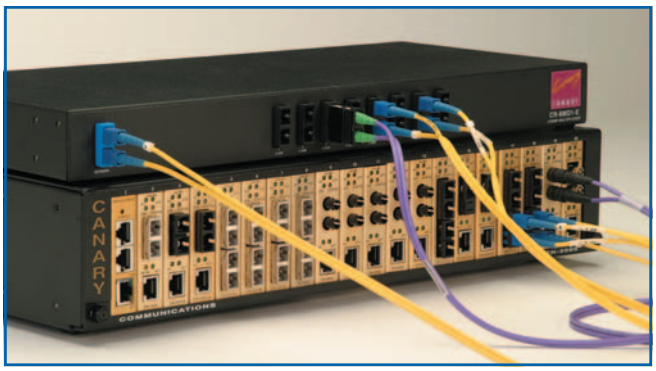
Model Numbers	Descriptions (OADMs & Multiplexer / De-Multiplexers)	Insertion Loss at Multiplexer and/or De-Multiplexer point		Insertion Loss Per OADM Drop point		Insertion Loss Per OADM Add point		Insertion Loss Per OADM Pass-Thru point	
		Typical	Maximum	Typical	Maximum	Typical	Maximum	Typical	Maximum
CN-4MD6-A/B	4-Channel Mux/Demux Groups A or B λs (Wavelengths)	1.2 dB	2.4 dB	Not Applicable		Not Applicable		Not Applicable	
CN-4MD6-SFA*	4-Channel Mux/Demux Single-Fiber, Bi-Directional, TX: Grp. A λs, RX: Grp. B λs	2.4 dB	3.4 dB	Not Applicable		Not Applicable		Not Applicable	
CN-4MD6-SFB*	4-Channel Mux/Demux Single-Fiber, Bi-Directional, TX: Grp. B λs, RX: Grp. A λs	2.4 dB	3.4 dB	Not Applicable		Not Applicable		Not Applicable	
CN-8MD6-E/F	8-Channel Mux/Demux Groups E or F λs (Wavelengths)	2.4 dB	3.4 dB	Not Applicable		Not Applicable		Not Applicable	
The following Optical Add/Drop Multiplexer (OADM) entries are included for reference. Details of their use may be found in the CWDM Passive Multiplexer/De-Multiplexer data sheets.									
AD1-47-S1 thru AD1-61-S1	1-Channel OADM, 1-λ One SC Client-Add/Drop port	Not Applicable		1.0 dB	1.4 dB	1.0 dB	1.4 dB	0.5 dB	1.0 dB
AD2-47-S1 thru AD2-61-S1	2-Channel OADM, 1-λ Two SC Client-Add/Drop ports	Not Applicable		1.0 dB	1.4 dB	1.0 dB	1.4 dB	0.5 dB	1.0 dB
AD2-4751-S1 thru AD2-5761-S1	2-Channel OADM, 2-λs Two SC Client-Add/Drop ports	Not Applicable		1.0 dB	1.7 dB	1.0 dB	1.7 dB	0.8 dB	1.4 dB
AD4-4A-S1 and AD4-4B-S1	4-Channel OADM, 4-λs Four SC Client-Add/Drop ports	Not Applicable		1.0 dB	2.4 dB	1.0 dB	2.4 dB	1.0 dB	2.0 dB

** Single-Fiber Bi-Directional, 4-channel Multiplexer/De-Multiplexers must be connected as complementary SFA & SFB pairs i.e. one SFA unit must be connected with one SFB unit to establish a proper, functioning data link across the single-mode fiber cable.*

All models of Passive Multiplexer / De-Multiplexers & OADMs use SC connectors as standard for single-mode network (loop) connections. Client ports can be either SC or LC style fiber connectors.

There are eighteen CWDM wavelengths (λs) specified. Eight standard wavelengths plus four O-band λs are useable over most standard single-mode fiber. Canary offers products for the standard eight wavelengths plus four O-band λs e.g. 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610 ηm + 1290, 1310, 1330, 1350 ηm

Optical Insertion Losses



Illustrated: CCM-2000 Chassis with CWDM Multiplexer

The following definitions and explanations are used in estimating accumulated Optical Insertion Losses.

1. Multiplexer/De-Multiplexer stages: where multiple channel wavelengths (four, eight or twelve) are initially combined and coupled to a single-mode fiber cable or de-coupled and separated into individual channels - typically at fiber cable end-points i.e. at Origin CWDM launch-points and at (Remote) CWDM channel end-points.

2. Drop-Point - an OADM function: where one or more wavelengths (user channels) are de-coupled from the fiber cable at an intermediate location along the cable span i.e. a branching point.

3. Add-Point – an OADM function: an intermediate location where one or more wavelengths (user channels) are re-inserted (coupled) onto the fiber cable for the Return-path trip (back) to the CWDM Origin.

4. Pass-Thru – an OADM function: Forwarding or "Passing" through the OADM, that fraction of channel wavelengths that are not being de-coupled at that intermediate point. The forwarded wavelengths continuing along the fiber-cable towards the next intermediate OADM 'Drop'-point or to the Remote site CWDM end-point.

5. The Optical Insertion Losses through each device are treated as equivalent for all wavelengths for calculation purposes.

6. Insertion Loss can be estimated (calculated) in a "forward" direction i.e. from Origin to Remote End-point or from any OADM user-channel "Add/Drop" point forward to the Remote End-point.

7. Total insertion Loss should also be estimated for the Return-path i.e. from the Remote End-point to the Origin, or from any OADM "Add/Drop" point to the Origin.

8. In some cases, calculation results accumulated in a "forward" direction may be equal to the Return-path calculation results, suggesting a symmetrical relationship. This should not be assumed to be always true. In order to identify critical network power-budget constraints, accumulated device Optical Insertion Losses should be independently calculated for each path direction and for each starting point i.e. "Add-Point" (stage) where an optical signal is inserted into the fiber cable.

9. The results of CWDM device Optical Insertion Loss calculations must be factored into other typical network Optical Budget calculations in order to get an accurate estimate of the total fiber optic Power Budget available to the network designer.

Optical Insertion Losses

The following Sections present examples of Optical Insertion Loss estimation with calculations, in tabular form. A simple diagram is included for each example.

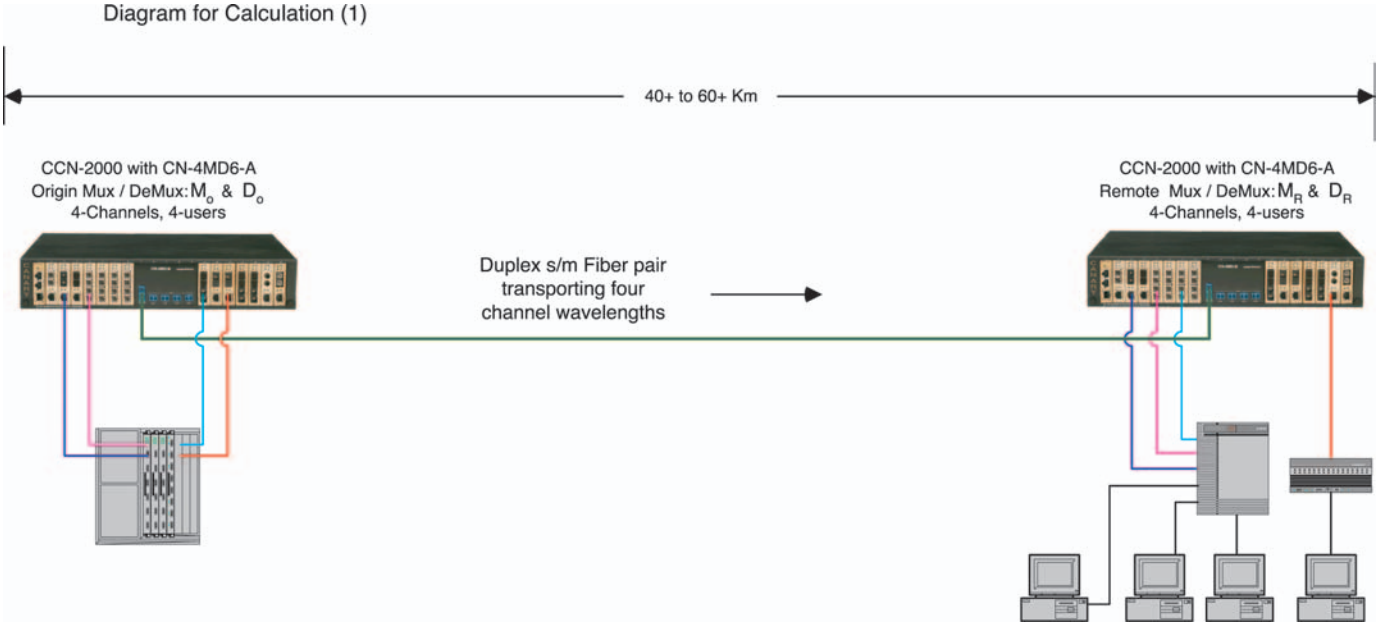
Each diagram displays the logical device-paths used for Optical Insertion Loss calculations through each stage of Canary Multiplexer / De-Multiplexers (four & eight-channels) and OADMs that service one, two and four Client-channel Drops & Adds (signal reinsertions).

Optical Insertion Loss estimation:

- Example 1 of Origin to Remote-Point (link) Loss Calculation with no intermediate OADM (client Drop, Add or Pass-Thru) stages (or their associated OADM Optical Insertion Losses).
- Calculates accumulated typical and maximum path Losses from Origin to Remote end-point.
- Given: Origin and Remote site Multiplexer/De-Multiplexer losses (Mux/De-Mux) and no OADMs in the optical path.
- Origin Chassis Multiplexer/De-Multiplexer (CM-4MD6-A) stage denoted by M_O & D_O and Remote Mux & De-Mux (CM-4MD6-A) stage denoted by M_R & D_R

Table (C-1)

Insertion Loss: Each Mux + De-Mux stage (typically at segment end-points)		Insertion Loss (1st) Drop point	Insertion Loss (1st) Add point	Insertion Loss (1st) Pass-Thru	Acc. Loss at (1st) Drop point	Insertion Loss (2nd) Drop point	Insertion Loss (2nd) Add point	Insertion Loss (2nd) Pass-Thru	Acc. Loss at (2nd) Drop point	Total Loss at end-point Demux w/ no Pass-Thru stages
(M_O & D_O)	(M_R & D_R)									(M_O + D_R)
1.2 dB	1.2 dB	None:	None:	None:	None:	None:	None:	None:	None:	
(Typical Optical Loss)		No OADM	No OADM	No OADM	No OADM	No OADM	No OADM	No OADM	No OADM	2.4 dB
2.4 dB	2.4 dB	None:	None:	None:	None:	None:	None:	None:	None:	
(Maximum Optical Loss)		No OADM	No OADM	No OADM	No OADM	No OADM	No OADM	No OADM	No OADM	4.8 dB



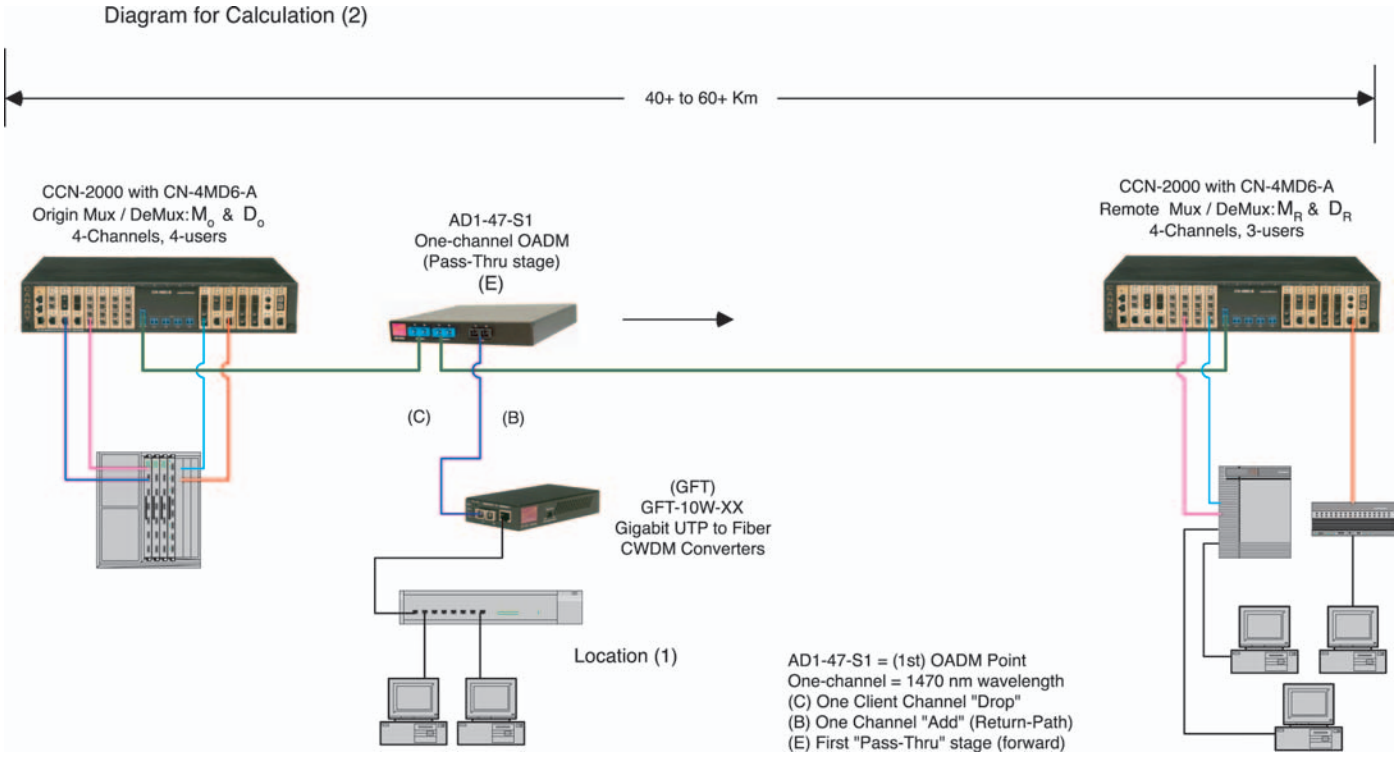
Optical Insertion Losses

Optical Insertion Loss estimation:

- Example 2 of Origin to Remote (Point-to-Point) (link) Loss Calculation with one intermediate OADM (client Drop, Add and Pass-Thru) stage – assumes one λ per Drop (and associated OADM Insertion Losses).
- Calculates accumulated typical and maximum path Losses from Origin through one OADM stage to Remote end-point.
- Given: Origin Multiplexer/De-Multiplexer (CM-4MD6-A) losses (M_O & D_O) and Remote site Mux/De-Mux(CM-4MD6-A) losses (M_R & D_R) plus one OADM point losses (C, B, E) in the optical path.

Table (C-2)

Insertion Loss: Each Mux + De-Mux stage (typically at segment end-points)		Insertion Loss (1st) Drop point	Insertion Loss (1st) Add point	Insertion Loss (1st) Pass-Thru	Acc. Loss at (1st) Drop point	Insertion Loss (2nd) Drop point	Insertion Loss (2nd) Add point	Insertion Loss (2nd) Pass-Thru	Acc. Loss at (2nd) Drop point	Total Loss at end-point Demux w/ one Pass-Thru stage
(M_O & D_O)	(M_R & D_R)	(C)	(B)	(E)	(M_O + C)					(M_O + E + D_R)
1.2 dB	1.2 dB	1.0 dB	1.0 dB	0.5 dB	2.2 dB	None: No OADM	None: No OADM	None: No OADM	None: No OADM	2.9 dB
(Typical Optical Loss)										
2.4 dB	2.4 dB	1.4 dB	1.4 dB	1.0 dB	3.8 dB	None: No OADM	None: No OADM	None: No OADM	None: No OADM	5.8 dB
(Maximum Optical Loss)										



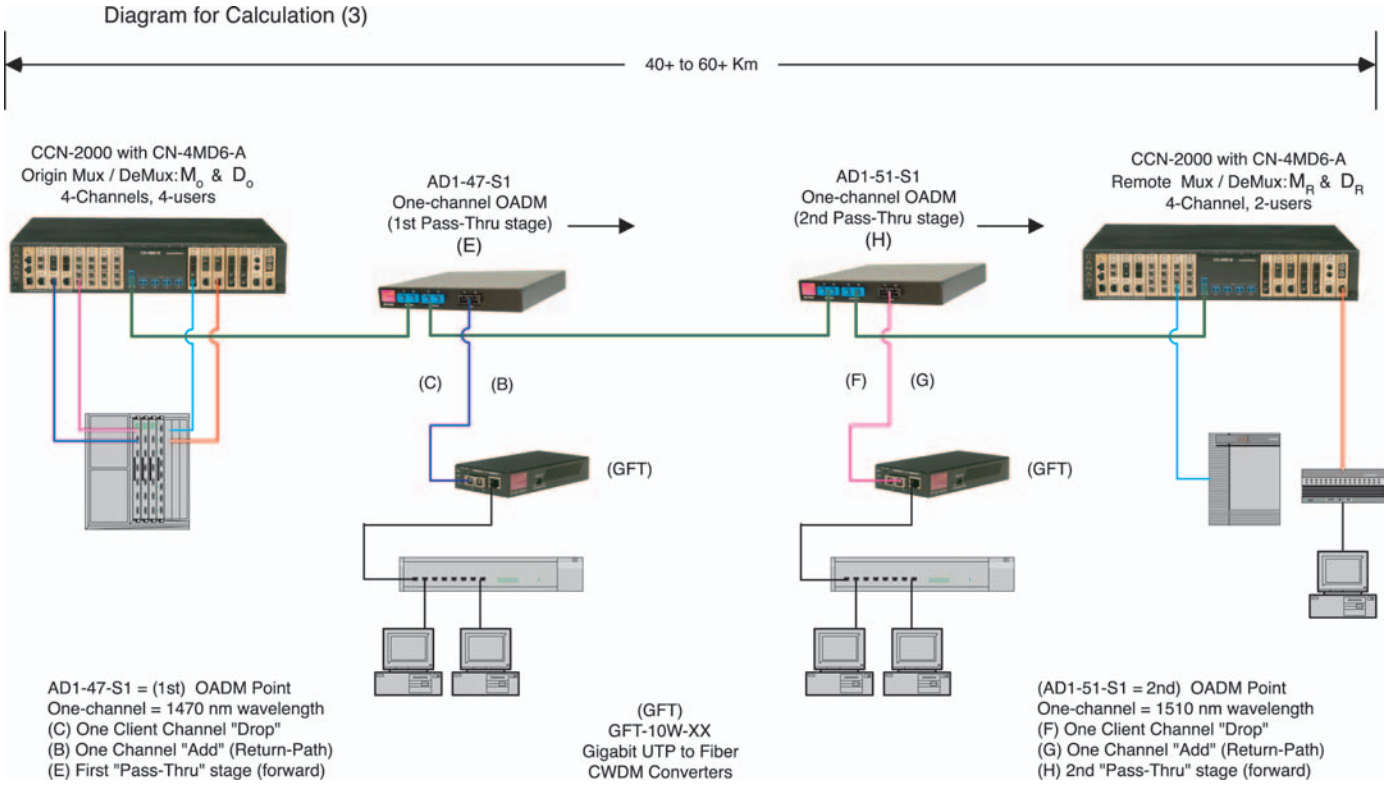
Optical Insertion Losses

Optical Insertion Loss estimation:

- Example 3 of Origin to Remote (Point-to-Point) (link) Loss Calculation with two intermediate, OADM (client Drop, Add and Pass-Thru) stages – assumes one λ per OADM Drop-point.
- Calculates accumulated typical and maximum path Losses from Origin through two OADM stages to Remote end-point.
- Given: Origin Multiplexer/De-Multiplexer (CM-4MD6-A) losses (M_O & D_O) and Remote site Mux/De-Mux (CM-4MD6-A) losses (M_R & D_R) plus two OADM points & losses (C, B, E) and (F, G, H) in the optical path.

Table (C-3)

Insertion Loss: Each Mux + De-Mux stage (typically at segment end-points)		Insertion Loss (1st) Drop point	Insertion Loss (1st) Add point	Insertion Loss (1st) Pass-Thru	Acc. Loss at (1st) Drop point	Insertion Loss (2nd) Drop point	Insertion Loss (2nd) Add point	Insertion Loss (2nd) Pass-Thru	Acc. Loss at (2nd) Drop point	Total Loss at end-point Demux w/ two Pass-Thru stages
(M_O & D_O)	(M_R & D_R)	(C)	(B)	(E)	(M_O + C)	(F)	(G)	(H)	(M_O + E + F)	(M_O + E + H + D_R)
1.2 dB	1.2 dB	1.0 dB	1.0 dB	0.5 dB	2.2 dB	1.0 dB	1.0 dB	0.5 dB	2.7 dB	3.4 dB
(Typical Optical Loss)										
2.4 dB	2.4 dB	1.4 dB	1.4 dB	1.0 dB	3.8 dB	1.4 dB	1.4 dB	1.0 dB	4.8 dB	6.8 dB
(Maximum Optical Loss)										



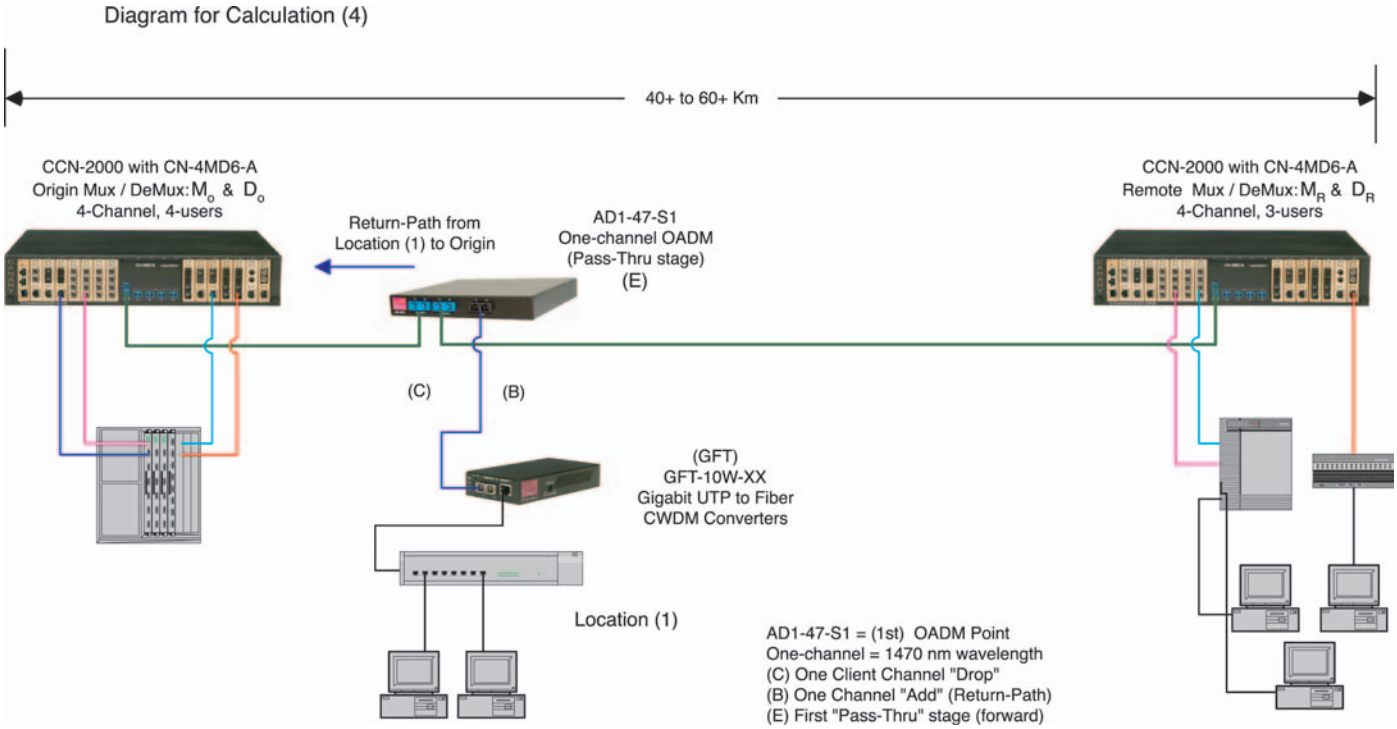
Optical Insertion Losses

Optical Insertion Loss estimation:

- Example 4 of Return-path (link) Loss calculation between one intermediate OADM (client Drop, Add and Pass-Thru) stage and the Origin – assumes one λ per Drop point.
- Calculates typical and maximum Return-path Losses from one OADM (client Add/Drop-point) to Origin.
- Given: Origin Multiplexer/De-Multiplexer (CM-4MD6-A) losses (M_O & D_O) plus one OADM point losses (C, B, E) in the optical path. The Remote site (Mux/De-Mux) is ignored for this calculation example.

Table (C-4)

Insertion Loss: Each Mux + De-Mux stage (typically at segment end-points)		Insertion Loss (1st) Drop point	Insertion Loss (1st) Add point	Insertion Loss (1st) Pass-Thru	Acc. Loss at (1st) Drop point	Insertion Loss (2nd) Drop point	Insertion Loss (2nd) Add point	Insertion Loss (2nd) Pass-Thru	Acc. Loss at (2nd) Drop point	Total Loss at start-point Demux w/ one Add (return) stage & no Pass-Thru stage
(M_O & D_O)	(M_R & D_R)	(C)	(B)	(E)	(M_O + C)					(B + D_O)
1.2 dB	1.2 dB	1.0 dB	1.0 dB	0.5 dB	2.2 dB	None: No OADM	None: No OADM	None: No OADM	None: No OADM	2.2 dB
(Typical Optical Loss)										
2.4 dB	2.4 dB	1.4 dB	1.4 dB	1.0 dB	3.8 dB	None: No OADM	None: No OADM	None: No OADM	None: No OADM	3.8 dB
(Maximum Optical Loss)										



Optical Insertion Losses

Optical Insertion Loss estimation:

- Example 5 of Return-path link (Loss) calculation that considers the Origin and two intermediate, OADM (client Drop, Add and Pass-Thru) stages – assumes one λ per Drop point.
- Calculates typical and maximum Return-path Losses from furthest (2nd) OADM (client Add/Drop-point) to Origin.
- Given: Origin Multiplexer/De-Multiplexer (CM-4MD6-A) losses (M_O & D_O) plus two OADM points & losses (C, B, E) and (F, G, H) in the optical path. The Remote site (Mux/De-Mux) is ignored for this calculation example.

Table (C-5)

Insertion Loss: Each Mux + De-Mux stage (typically at segment end-points)		Insertion Loss (1st) Drop point	Insertion Loss (1st) Add point	Insertion Loss (1st) Pass-Thru	Acc. Loss at (1st) Drop point	Insertion Loss (2nd) Drop point	Insertion Loss (2nd) Add point	Insertion Loss (2nd) Pass-Thru	Acc. Loss at (2nd) Drop point	Total Loss at start-point Demux w/ one Add (return) stage & one Pass-Thru stage
(M_O & D_O)	(M_R & D_R)	(C)	(B)	(E)	(M_O + C)	(F)	(G)	(H)	(M_O + E + F)	(G + E + D_O)
1.2 dB	1.2 dB	1.0 dB	1.0 dB	0.5 dB	2.2 dB	1.0 dB	1.0 dB	0.5 dB	2.7 dB	2.7 dB
(Typical Optical Loss)										
2.4 dB	2.4 dB	1.4 dB	1.4 dB	1.0 dB	3.8 dB	1.4 dB	1.4 dB	1.0 dB	4.8 dB	4.8 dB
(Maximum Optical Loss)